Rockfish Fecundity Cruise (GBR-R82-1), November 8-28,1982

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July 1985

Canadian Data Report of Fisheries and Aquatic Sciences No. 526

86-0377/

Canadian Data Report of Fisheries and Aquatic Sciences

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Cat. No. Fs 97-13/526E ISSN 0706-6465

Correct citation for this publication:

Leaman, B. M., D. A. Nagtegaal, R. D. Stanley, and E. W. Carter. 1985. Rockfish fecundity cruise (GBR-R82-1), November 8-28, 1982. Can. Data Rep. Fish. Aquat. Sci. 526: 64 p.

ABSTRACT

Leaman, B. M., D. A. Nagtegaal, R. D. Stanley, and E. W. Carter. 1985. Rockfish fecundity cruise (GBR-R82-1), November 8-28, 1982. Can. Data Rep. Fish. Aquat. Sci. 526: 64 p.

Preliminary results of a research cruise to collect reproductive biology data from five stocks of Pacific ocean perch (Sebastes alutus) in B.C. waters are presented. The cruise sampled stocks off southwest Vancouver Island, Queen Charlotte Sound, Hecate Strait, West Queen Charlotte Islands and Dixon Entrance. Mean round weights, ovary weights and length-maturity data are presented, along with detailed catch information and sea temperature observations. Length-weight regressions are compared with previous data for the species.

Key words: Sebastes alutus, length-weight, ovary weight

RÉSUMÉ

Leaman, B. M., D. A. Nagtegaal, R. D. Stanley, and E. W. Carter. 1985. Rockfish fecundity cruise (GBR-R82-1), November 8-28, 1982. Can. Data Rep. Fish. Aquat. Sci. 526: 64 p.

Le présent rapport porte sur les résultats préliminaires d'une expédition de recherche réalisée en vue de recueillir des données dur la reproduction de cinq stocks de sébaste à longue mâchoire (Sebastes alutus) peuplant les eaux de la Colombie-Britannique. On a échantillonné les stocks au large de la côte sud-ouest de l'île Vancouver, du bassin Reine-Charlotte, du détroit d'Hecate, des eaux à l'ouest des îles Reine-Charlotte et de l'entrée Dixon. Le poids entier moyen, le poids des ovaires et des données sur la longueur à la maturité sont présentées en plus d'information détaillée sur les prises et des observations sur la température du milieu. Les régressions de la longueur en fonction du poids sont comparées avec des données préalables sur l'espèce.

Mots-clés: Sebastes alutus, longueur-poids, poids des ovaires

INTRODUCTION

The Groundfish and Fisheries Ecology Program at the Pacific Biological Station has presented several major revisions of rockfish (Sebastes spp.) biology in recent years (Nagtegaal 1983, Archibald et al. 1983, Shaw and Archibald 1981). The major impetus for these revisions was an altered perspective on life span arising from improved ageing techniques (Archibald et al. 1981). Elsewhere (Leaman and Beamish 1984), we have commented on the general implications of longevity but the specific details of responses to exploitation by such species remain unknown.

The reproductive biology of long-lived species is believed to occupy a central role in their evolutionary persistence and resilience to exploitation pressure. In 1982 a detailed study of the reproductive biology of Pacific ocean perch (S. alutus) was initiated. It will examine both the normal variation in age-specific reproductive parameters (fecundity, egg size, egg weight) as well as modifications arising from exploitation effects. This report presents data from a research cruise examining these features for five different 'stocks' of S. alutus in B.C. waters. The five stocks are from southwest Vancouver Island (WCVI), Goose Island gully (GIG), Moresby gully (MOR), Rennell Sound (RSD), and Langara Spit (LA) (Fig. 1). They are characterized by large differences in exploitation histories and present stock size, which facilitates examination of exploitation responses.

Raw data and some preliminary compilations are included here, detailed analyses will be presented in future reports.

METHODS

Collections were made from the R/V G.B. REED, a 53.9 m side trawler, using a Nor'Eastern bottom trawl with 8.9 cm mesh codend. This trawl has a 32 m footrope equipped with 46 cm bobbins on the groundline, and is rigged with three bridles to permit a large vertical opening (9.4 m). The cruise extended from November 8-28, 1982 and hauls were made at locations where S. alutus was known (through previous research or commercial fishing records) to occur. Fishing occurred at deeper depths than normally sampled because of seasonal bathymetric migration by the fish.

Where catches were sufficiently large, samples were obtained using the method of Westrheim (1967, 1976), except that more than two tubs were extracted at each opportunity due to the greater number of samples needed. Where total catches were small (<1000 kg), the entire catch of S. alutus was sampled. Fish were sampled for length, sex, round weight, and ovary weight. The sagittal otoliths were extracted and stored in glycerine/water. Ovaries were extracted, weighed and stored in Gilson's fluid or Smith's Formal Dichromate. These solutions were used for preserving ovaries destined for fecundity estimation and histological sections, respectively; their compositions follow:

Gilson's (1910) Fluid
equal parts of: glacial acetic acid
chloroform
60% ethyl alcohol

Smith's Formal Dichromate (Acetic)
equal parts of: Solution A: 8% KCr_2O_7 in H_2O
and
Solution B: 9% formaldehyde (40%)
5% glacial acetic acid
86% distilled H_2O
(after 48h, transfer to 3% formaldehyde for storage)

While it is generally recognized that fish size (length or weight) is highly correlated with reproductive characteristics, the influence of maternal age has seldom been investigated for strongly iteroparous species. Unfortunately, age-specific sampling for rockfishes is not practical in the field since the time required for ageing the samples would be prohibitive. Body length was therefore used as a sampling correlate of age. The strongly asymptotic growth of S. alutus combined with its longevity resulted in a length-stratified sampling scheme, to ensure sufficient representation of older fish. Sampling strata were based on previous length-age matrices (Shaw and Archibald 1981) and the allocation was as follows:

length interval	number of samples/cm interval
≤40 cm	5
41-43 cm	10
>43 cm	20

Priority was assigned to fecundity estimation and surplus samples were retained for histology studies. Weights for individual fish and ovaries were obtained with an electronic balance[1], to ± 0.1 gm.

Data were transformed and compared to the hypothetical relationship:

$$\log W = \log a + b \log L$$

The influence of round weight, somatic weight and length on ovarian weight was examined using stepwise, multiple linear regression; with increases in the R^2 value and decreases in the F statistic of the error terms, used as measures of significance for addition of variables.

Maturity was assessed by the criteria of Table 1 and maturity ogives constructed for each sex and stock. Size at first maturity was taken as the size at which 50% of individuals were mature (L_{50}).

Temperature observations were made at standard stations (Fig. 2, 3) throughout the cruise using expendable bathythermographs (XBTs).

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[1]K-TRON DP-1
K-TRON Arizona Inc.
Scottsdale, Arizona 82560

RESULTS

Catches and haul locations

A total of 27 hauls for fecundity sampling, and five exploratory hauls for juvenile fish, were made between November 10-27, 1983. Sampling for fecundity extended from southwest Vancouver Island to Dixon Entrance over depths from 180-380 m. The majority of the S. alutus catch originated in depths between 250-300 m. The five additional hauls were made in Laredo and Smith sounds in search of pre-recruit, juvenile S. alutus (≤4y). The latter area has previously contained juveniles of particularly strong ocean perch cohorts (Westrheim 1973).

A summary of total catch, by species, is contained in Table 2. Bridge log and haul data are presented in Appendix Table 1, and haul locations are shown in Fig. 4-6.

Biological sampling

Table 3 presents a summary of biological samples obtained during the cruise. Fewer ovaries were collected from Rennell Sd. and Langara than other areas because of low abundance of S. alutus at the former location and fewer, larger fish (>43 cm) at the latter. For most stocks sampled, it was impossible to obtain 20 fish/cm for sizes >45 cm due to low abundance of large fish.

A total of 743 ovaries was collected, of which 654 were preserved in Gilson's fluid and 89 in Smith's Formal Dichromate. The majority of the ovaries for histological studies came from the highly exploited Vancouver Island stock and the lightly exploited Moresby gully stock (Table 3). Thirty-seven of the fecundity samples were subsequently found to be unsuitable for processing due to immaturity or insufficient breakdown of the vascular and connective tissues around the oocytes.

Some difficulties with the electronic balance were encountered. Previous uses of this model had been satisfactory but performance on this cruise was degraded by even moderate sea conditions (2.0 m swell). Therefore weights were not obtained for all segments of some samples. Tables 4 to 8 contain mean fish round weights, ovarian weights and their standard errors, by length, for each stock unit. The parameters of the relationship $W=aL^b$ are presented, by sex and stock, in Table 9. Weight as a function of length was adequately described by this relationship for all stocks ($r>0.97$; Res M.S.<0.01) but some differences in the pattern of growth among stocks are evident. Clinal changes in growth patterns of fish are expected and well documented, however the observed differences in these S. alutus stock reflect the additional influence of exploitation. The highly exploited stocks (LA, GIG, WCVI) all show lower b and higher a values for the length-weight function, resulting in larger weights-at-length earlier in life but lower asymptotic weights.

Westrheim and Thomson (1971) examined weight-length relationships of S. alutus off southwest Vancouver Island and Queen Charlotte Sound during

February, June and September, 1969. They noted up to 12% differences in weights for the same length interval between winter and mid-summer, resulting in significantly different parameters for the weight-length relationship. However, they deemed the statistical segregations of these estimates overly sensitive and derived average estimates through subsampling of the pooled data. Their individual and pooled estimates are presented in Table 10. The most appropriate comparison with our data is for the February period, when ovaries would still be fully developed. While only WCVI data are available from the earlier study, the differences correlated with exploitation noted above for the present study, are mirrored in comparison with the historical data. It is reasonable to ask whether the status of the WCVI stock in 1969 is similar to the MOR and RSD stocks in 1982. Gunderson (1977) notes that major exploitation of the WCVI stock did not begin until 1965 and the influence of this exploitation on incoming cohorts in 1969 would have been relatively minor, due to their high age at first capture. The analogy presented above appears justified and indicates growth changes associated with biomass (and presumably density) change.

Sizes at maturity (Figs. 7-11) differed little among stocks, although the L_{50} for Rennell Sd. is poorly determined due to the low abundance of juvenile fish. We have previously speculated (Leaman and Nagtegaal 1982) on the basis of this low abundance, that the Rennell Sd. stock may not be self-supporting and may require recruitment from other areas for maintenance. While there is low variation in size at maturity among stocks the growth changes noted above suggest younger ages at maturity for the three exploited stocks (WCVI, GIG and LA). Maturity observations by stock and sex are presented in Table 11.

Oceanographic data

Tables 12-14 present surface and bottom temperatures collected at the standard oceanographic stations. Temperature ranges for surface and bottom temperatures were 8.0-11.9°C and 3.4-12.5°C, respectively. Maximum surface-bottom differences were recorded off Vancouver Island and minimum differences off the Queen Charlotte Islands.

ACKNOWLEDGMENTS

We are grateful to the master and crew of the R/V G.B. REED for their able assistance throughout this cruise. We also thank John Bagshaw for his valuable advice on the preservation and oocyte liberation media used during this study.

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Table 1. Description of rockfish maturity stages.

Maturity code			Gonad condition
Females:	1	Immature	(translucent, small)
	2	Maturing	(small, yellow eggs; translucent or opaque)
	3	Mature	(large, yellow eggs; opaque)
	4	Fertilized	(large, orange-yellow eggs; translucent)
	5	Embryos or Larvae	(includes eyed eggs)
	6	Spent	(large, flaccid, red ovaries. A few larvae may be present)
	7	Resting	(moderate size, form, red-grey ovaries)
Males:	1	Immature	(translucent, stringlike)
	2	Maturing	(swelling, brown-white)
	4	Mature	(large, white; easily broken)
	5	Ripe	(running sperm)
	6	Spent	(flaccid, red)
	7	Resting	(ribbon-like; small, brown)

Table 2. Total catch by species, R/V G.B. REED, Nov. 8-28, 1982.

SPECIES NAME	WEIGHT (kg)	PERCENT
Atheresthes stomias	1,273	3.33
Microstomus pacificus	788	2.06
Sebastes alutus	8,381	21.94
S. diploproa	2,229	5.83
S. reedi	4,672	12.23
Anoplopoma fimbria	902	2.36
Squalus acanthias	18,500	48.43
Others	1,458	3.82
Total	38,203	100.00

Table 3. Biological samples collected, R/V G.B. REED, Nov. 8-28, 1982.

Species	Area	Sample type	No. of otoliths collected	No. of ovaries collected
S. alutus	Big Bank	LEN/SEX/MAT/OTO/OVA	236	236
"	Estevan	"	103	
"	S.E. Corner (Goose Is. Gully)	"	446	111
"	S. Moresby	"	503	170
"	Rennell Sd.	"	241	129
"	Langara Is.	"	227	97
"	Laredo Sd.	LEN/SEX/MAT/OTO*	7	-
"	Smith Sd.	" *	1	-
S. aleutianus	Laredo Sd.	" *	6	-
"	Smith Sd.	" *	5	-
S. diploproa	Laredo Sd.	" *	2	-
		Fecundity sampling totals	1,756	743
		Juvenile sampling total	21	-

*Juvenile rockfish

Table 4. Mean fish weight (by sex), ovary weight and their standard errors by length for Vancouver Island, S. alutus, R/V G.B. REED, Nov. 8-28, 1982.

WEST COAST OF VANCOUVER ISLAND

Length (cm)	Females						Males		
	Mean fish wt. (gm)	N	SE	Mean ovary wt. (gm)	N	SE	Mean fish wt. (gm)	N	SE
24							207	5	7.6
5	222	5	9.9	-	-	-	221	11	5.7
6	281	6	14.8	-	-	-	258	12	6.2
7	290	7	13.5	-	-	-	290	10	8.5
8	326	7	7.0	-	-	-	319	6	10.4
9	357	9	10.9	16	1	-	365	7	6.5
30	394	4	13.0	4	1	-	378	4	10.2
1	440	2	31.0	-	-	-	439	5	6.9
2	481	3	12.5	-	-	-	499	2	19.0
3	522	5	14.2	6	2	1.5	507	4	39.2
4	550	2	20.5	4	1	-	561	3	9.1
5	602	6	25.1	10	5	3.5	571	5	14.9
6	707	4	16.5	18	4	5.2	683	4	9.6
7	764	5	28.4	20	5	6.6	699	5	14.0
8	856	5	28.6	32	5	4.1	783	5	22.2
9	916	5	11.8	36	5	3.9	819	5	26.7
40	958	10	19.1	40	10	2.4	895	5	24.5
1	996	10	25.5	41	10	2.8	905	1	-
2	1076	10	22.0	45	10	2.4	980	3	13.7
3	1207	13	19.7	51	13	1.8	-	-	-
4	1306	21	16.6	67	21	3.4	-	-	-
5	1377	20	10.6	60	20	2.2	-	-	-
6	1496	22	24.9	68	22	2.9	-	-	-
7	1557	11	32.1	62	11	3.3	-	-	-
8	1676	1	-	66	1	-	-	-	-
9	1725	2	2.0	54	1	-	-	-	-

Table 5. Mean fish weight (by sex), ovary weight and their standard errors by length for Goose Is. gully, S. alutus, R/V G.B. REED, Nov. 8-28, 1982.

GOOSE ISLAND GULLY

Length (cm)	Females						Males		
	Mean fish wt. (gm)	N	SE	Mean ovary wt. (gm)	N	SE	Mean fish wt. (gm)	N	SE
24	-	-	-	-	-	-	202	1	-
5	219	3	14.4	-	-	-	223	4	4.6
6	259	9	5.5	-	-	-	259	13	3.2
7	286	9	5.7	-	-	-	288	13	3.9
8	323	7	8.9	-	-	-	323	14	5.2
9	332	1	-	-	-	-	361	3	15.1
30	-	-	-	-	-	-	412	3	16.3
1	459	1	-	-	-	-	414	1	-
2	509	1	-	-	-	-	463	2	10.5
3	-	-	-	-	-	-	526	2	15.5
4	621	1	-	2	1	-	542	3	15.1
5	581	1	-	2	1	-	581	5	15.2
6	624	1	-	2	1	-	623	10	10.5
7	792	2	10.0	4	2	3.5	714	4	13.6
8	922	5	90.3	35	5	7.8	754	14	16.3
9	1021	2	59.5	33	2	7.0	794	5	37.2
40	956	8	17.5	30	8	3.2	926	8	16.4
1	1004	11	14.0	38	11	2.7	943	4	29.3
2	1154	10	17.9	45	10	2.4	1061	5	24.4
3	1253	11	32.2	53	11	3.5	1204	2	8.0
4	1299	11	21.4	54	11	4.0	-	-	-
5	1468	3	17.2	71	3	6.4	1277	1	-

Table 6. Mean fish weight (by sex), ovary weight and their standard errors by length for Moresby Gully S. alutus, R/V G.B. REED, Nov. 8-28, 1982.

MORESBY

Length (cm)	Females						Males		
	Mean fish wt. (gm)	N	SE	Mean ovary wt. (gm)	N	SE	Mean fish wt. (gm)	N	SE
20	-	-	-	-	-	-	120	1	-
23	164	3	6.2	-	-	-	162	1	-
4	191	4	0.9	-	-	-	183	5	5.0
5	222	4	7.7	-	-	-	223	5	5.5
6	238	5	8.8	-	-	-	240	5	10.8
7	275	6	2.9	-	-	-	273	4	3.9
8	307	4	14.2	-	-	-	312	5	12.8
9	337	5	16.1	-	-	-	343	1	-
30	400	2	49.0	-	-	-	389	3	14.8
1	400	4	12.3	3	1	-	426	3	26.7
2	496	3	13.2	-	-	-	447	3	26.3
3	528	3	13.4	-	-	-	527	3	2.0
4	569	4	32.8	4	2	1.5	559	3	34.1
5	639	6	26.8	6	4	1.6	593	3	8.5
6	724	6	22.3	24	4	9.5	652	4	23.2
7	735	2	20.5	15	2	1.0	657	7	17.5
8	790	5	21.4	17	4	1.4	729	7	12.5
9	880	6	36.9	20	4	6.4	806	12	15.8
40	966	9	13.4	42	7	3.2	862	10	0.3
1	1087	10	22.6	42	7	0.3	947	19	15.9
2	1151	9	31.1	56	7	4.3	1052	8	25.9
3	1277	10	32.1	58	8	7.1	1061	6	29.2
4	1373	19	22.4	65	17	6.1	1152	3	21.0
5	1448	20	25.1	70	18	3.8	1319	1	-
6	1566	9	24.6	77	9	7.1	-	-	-
7	1639	5	79.2	85	5	9.3	-	-	-
8	1725	6	48.7	84	6	12.6	-	-	-
9	-	-	-	-	-	-	-	-	-
50	2136	1	-	91	1	-	-	-	-

Table 7. Mean fish weight (by sex), ovary weight and their standard errors by length for Rennell Sound, S. alutus, R/V G.B. REED, Nov. 8-28, 1982.

RENNELL SOUND

Length (cm)	Females						Males		
	Mean fish wt. (gm)	N	SE	Mean ovary wt. (gm)	N	SE	Mean fish wt. (gm)	N	SE
22	-	-	-	-	-	-	149	1	-
24	-	-	-	-	-	-	176	1	-
25	214	3	8.8	-	-	-	223	1	-
6	242	3	4.5	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	299	2	12.5	-	-	-	326	1	-
9	-	-	-	-	-	-	312	1	-
35	-	-	-	-	-	-	578	1	-
6	-	-	-	-	-	-	691	2	14.5
7	-	-	-	-	-	-	703	5	12.7
8	-	-	-	-	-	-	756	7	16.0
9	839	2	44.0	33	2	15.0	841	9	13.9
40	903	9	24.9	39	9	4.6	889	12	15.7
1	1011	12	20.8	52	12	4.8	978	19	17.8
2	1114	12	32.3	72	12	7.4	1064	28	13.6
3	1193	14	31.0	75	13	5.6	1130	10	21.4
4	1281	20	23.2	75	20	2.8	1180	5	34.9
5	1380	22	30.0	77	22	4.1	-	-	-
6	1566	16	28.4	89	16	3.6	-	-	-
7	1715	15	37.1	97	15	4.8	-	-	-
8	1799	7	34.1	112	7	4.7	-	-	-
9	1744	1	-	88	1	-	-	-	-

Table 8. Mean fish weight (by sex), ovary weight and their standard errors by length for Langara Spit, S. alutus, R/V G.B. REED Nov. 8-28, 1982.

LANGARA

Length (cm)	Females						Males		
	Mean fish wt. (gm)	N	SE	Mean ovary wt. (gm)	N	SE	Mean fish wt. (gm)	N	SE
26	-	-	-	-	-	-	240	1	-
7	267	2	1.0	-	-	-	-	-	-
8	-	-	-	-	-	-	286	1	-
9	-	-	-	-	-	-	338	1	-
30	429	1	-	-	-	-	428	1	-
1	407	1	-	-	-	-	421	5	5.9
2	454	3	13.7	-	-	-	456	4	12.8
3	498	4	14.4	6	1	-	510	4	27.3
4	564	2	23.0	-	-	-	526	4	10.0
5	632	5	12.3	16	3	3.5	564	10	10.4
6	697	6	20.7	16	6	5.2	643	9	18.4
7	733	8	15.2	25	7	2.8	660	23	6.7
8	814	8	20.0	29	7	2.4	727	27	7.8
9	885	7	17.1	35	7	3.1	773	9	7.0
40	933	13	8.1	39	13	2.3	867	7	12.4
1	999	12	19.8	45	12	2.8	988	6	15.6
2	1067	12	18.9	47	12	2.8	-	-	-
3	1154	12	16.3	61	12	4.5	-	-	-
4	1297	7	48.8	73	6	3.9	-	-	-
5	1293	5	80.8	79	5	7.7	1317	1	-
6	1573	4	59.5	107	4	8.9	-	-	-
7	1730	2	22.5	113	2	13.0	-	-	-

Table 9. Parameters of the length-weight relationship ($W = aL^b$) for *S. alutus*, by stock and sex, R/V G.B. REED November 8-28, 1982.

Stock	N	a	b	r1	Residual[2] M.S.
		MALES			
West Vancouver Island	114	0.0217	2.8774	0.989	0.0010
Goose Is. Gully	112	0.0221	2.8729	0.993	0.0007
Moresby	123	0.0156	2.9637	0.993	0.0009
Rennell Sd.	103	0.0109	3.0695	0.984	0.0008
Langara	114	0.0197	2.8916	0.971	0.0007
TOTAL	566	0.0190	2.9117	0.9910	0.0009
		FEMALES			
West Vancouver Island	195	0.0122	3.0534	0.993	0.0010
Goose Is.	98	0.0097	3.1219	0.993	0.0012
Moresby	170	0.0059	3.2584	0.994	0.0010
Rennell Sd.	139	0.0051	3.2857	0.980	0.0015
Langara	117	0.0083	3.1532	0.981	0.0009
TOTAL	719	0.0086	3.1499	0.991	0.0012

[1]correlation of $\log W = \log a + b \log L$

[2]Residual mean square of above relation

Table 10. Parameters of the length-weight relationship ($W = aL^b$) for S. alutus from Westrheim and Thomson (1971).

	Vancouver Island			Queen Charlotte Sound		
Month	N	a	b	N	a	b
MALES						
February	214	.0182	2.9269	0	-	-
June	134	.0130	3.0245	159	.0154	2.9779
September	223	.0102	3.1035	265	.0081	3.1631
Pooled		400	.0113		3.0651	
FEMALES						
February	209	.0059	3.2547	0	-	-
June	153	.0170	2.9485	184	.0136	3.0069
September	249	.0102	3.1060	299	.0061	3.2379
Pooled		400	.0079		3.1673	
Sexes combined		400	.0089		3.1333	

Table 11. Summary of Sebastes alutus maturity condition, by stock, R/V G.B. REED, Nov. 8-28, 1982.

LOCALITY: Vancouver Island

	MALE						FEMALE						
CONDITION	1	2	4	5	6	7	1	2	3	4	5	6	7
LENGTH (cm)													
24	5	-	-	-		-	-	-	-	-	-	-	-
25	11	-	-	-		-	5	-	-	-	-	-	-
26	12	-	-	-		-	5	1	-	-	-	-	-
27	10	-	-	-		-	6	0	1	-	-	-	-
28	6	-	-	-		-	7	0	0	-	-	-	-
29	7	-	-	-		-	7	2	0	-	-	-	-
30	4	-	-	-		-	2	2	0	-	-	-	-
31	5	-	-	-		-	2	0	0	-	-	-	-
32	2	-	-	-		-	2	1	0	-	-	-	-
33	3	-	-	-		1	3	0	2	-	-	-	-
34	2	-	-	-		1	0	1	1	-	-	-	-
35	-	-	-	-		5	1	1	4	-	-	-	-
36	-	-	-	-		4	-	-	5	-	-	-	-
37	-	-	-	-		6	-	-	5	-	-	-	-
38	-	-	-	-		8	-	-	6	-	-	-	-
39	-	-	-	-		6	-	-	7	-	-	-	-
40	-	-	-	-		5	-	-	13	-	-	-	-
41	-	-	-	-		1	-	-	13	-	-	-	-
42	-	-	-	-		3	-	-	14	-	-	-	-
43	-	-	-	-		-	-	-	18	-	-	-	-
44	-	-	-	-		-	-	-	25	-	-	-	-
45	-	-	-	-		-	-	-	29	-	-	-	-
46	-	-	-	-		-	-	-	25	-	-	-	-
47	-	-	-	-		-	-	-	13	-	-	-	-
48	-	-	-	-		-	-	-	1	-	-	-	-
49	-	-	-	-		-	-	-	2	-	-	-	-
SUB TOTAL	67					40	40	8	184				
% MATURITY	63					37	17	4	79				
TOTAL	107						232						
SEX RATIO	31.6%						68.4%						

Table 11 (cont'd)

LOCALITY: Goose Island Gully (GIG)

	MALE						FEMALE						
CONDITION	1	2	4	5	6	7	1	2	3	4	5	6	7
LENGTH (cm)													
24	1	-	-	-	-	-	-	-	-	-	-	-	-
25	4	-	-	-	-	-	3	-	-	-	-	-	-
26	13	-	-	-	-	-	9	-	-	-	-	-	-
27	13	-	-	-	-	-	9	-	-	-	-	-	-
28	13	-	-	-	-	-	8	-	-	-	-	-	-
29	4	-	-	-	-	-	2	-	-	-	-	-	-
30	3	-	-	-	-	-	0	-	-	-	-	-	-
31	1	-	-	-	-	-	1	-	-	-	-	-	-
32	2	-	-	-	-	-	1	-	-	-	-	-	-
33	3	-	-	-	-	-	-	-	-	-	-	-	-
34	1	-	-	-	-	2	-	-	3	-	-	-	-
35	2	-	-	-	-	9	-	-	2	-	-	-	-
36	1	-	-	-	-	28	-	-	3	-	-	-	-
37	0	-	-	-	-	27	-	-	6	-	-	-	-
38	0	-	-	-	-	30	-	-	10	-	-	-	-
39	0	-	-	-	-	22	-	-	7	-	-	-	-
40	0	-	-	-	-	16	-	-	23	-	-	-	-
41	0	-	-	-	-	11	-	-	25	-	-	-	-
42	2	-	-	-	-	3	-	-	27	-	-	-	-
43	-	-	-	-	-	3	-	-	29	-	-	-	-
44	-	-	-	-	-	0	-	-	31	-	-	-	-
45	-	-	-	-	-	1	-	-	23	-	-	-	-
46	-	-	-	-	-	-	-	-	6	-	-	-	-
47	-	-	-	-	-	-	-	-	2	-	-	-	-
48	-	-	-	-	-	-	-	-	1	-	-	-	-
SUB TOTAL	63					152	33		198				
% MATURITY	30					70	14		86				
TOTAL	215								231				
SEX RATIO	48.2%								51.8%				

Table 11 (cont'd)

LOCALITY: Moresby Gully

	MALE						FEMALE						
CONDITION	1	2	4	5	6	7	1	2	3	4	5	6	7
LENGTH (cm)													
20	1	-	-	-	-	-		-	-	-	-	-	-
23	1	-	-	-	-	-	3	-	-	-	-	-	-
24	5	-	-	-	-	-	4	-	-	-	-	-	-
25	5	-	-	-	-	-	4	-	-	-	-	-	-
26	5	-	-	-	-	-	5	-	-	-	-	-	-
27	4	-	-	-	-	-	6	-	-	-	-	-	-
28	5	-	-	-	-	-	2	1	1	-	-	-	-
29	1	-	-	-	-	-	5	0	0	-	-	-	-
30	3	-	-	-	-	-	2	0	0	-	-	-	-
31	2	-	-	-	-	1	3	0	1	-	-	-	-
32	2	-	-	-	-	1	3	0	0	-	-	-	-
33	2	-	-	-	-	1	3	0	0	-	-	-	-
34	2	-	-	-	-	1	2	0	2	-	-	-	-
35	2	-	-	-	-	1	0	0	7	-	-	-	-
36	-	-	-	-	-	5	2	0	6	-	-	-	-
37	-	-	-	-	-	9	-	0	4	-	-	-	-
38	-	-	-	-	-	10	-	0	9	-	-	-	-
39	-	-	-	-	-	29	-	0	9	-	-	-	-
40	-	-	-	-	-	49	-	0	14	-	-	-	-
41	-	-	-	-	-	70	-	1	19	-	-	-	-
42	-	-	-	-	-	27	-	-	21	-	-	-	-
43	-	-	-	-	-	12	-	-	23	-	-	-	-
44	-	-	-	-	-	6	-	-	30	-	-	-	-
45	-	-	-	-	-	2	-	-	26	-	-	-	-
46	-	-	-	-	-	-	-	-	9	-	-	-	-
47	-	-	-	-	-	-	-	-	5	-	-	-	-
48	-	-	-	-	-	-	-	-	6	-	-	-	-
49	-	-	-	-	-	-	-	-	0	-	-	-	-
50	-	-	-	-	-	-	-	-	1	-	-	-	-
SUB TOTAL	40				224		44	2	193				
% MATURITY	16				84		19	1	80				
TOTAL	264						239						
SEX RATIO	52.5%						47.5%						

Table 11 (cont'd)

LOCALITY: Rennell Sd.

	MALE						FEMALE						
CONDITION	1	2	4	5	6	7	1	2	3	4	5	6	7
LENGTH (cm)													
22	1	-	-	-	-	-	-	-	-	-	-	-	-
24	1	-	-	-	-	-	-	-	-	-	-	-	-
25	1	-	-	-	-	-	3	-	-	-	-	-	-
26	0	-	-	-	-	-	3	-	-	-	-	-	-
28	1	-	-	-	-	-	2	-	-	-	-	-	-
29	1	-	-	-	-	-	-	-	-	-	-	-	-
35	1	-	-	-	-	-	-	-	-	-	-	-	-
36	-	-	-	-	-	2	-	-	-	-	-	-	-
37	-	-	-	-	-	5	-	-	-	-	-	-	-
38	-	-	-	-	-	7	-	-	-	-	-	-	-
39	-	-	-	-	-	9	-	-	2	-	-	-	-
40	-	-	-	-	-	12	-	-	9	-	-	-	-
41	-	-	-	-	-	19	-	-	12	-	-	-	-
42	-	-	-	-	-	28	-	-	12	-	-	-	-
43	-	-	-	-	-	10	-	-	13	-	-	-	1
44	-	-	-	-	-	5	-	-	21	-	-	-	-
45	-	-	-	-	-	-	-	-	22	-	-	-	-
46	-	-	-	-	-	-	-	-	16	-	-	-	-
47	-	-	-	-	-	-	-	-	15	-	-	-	-
48	-	-	-	-	-	-	-	-	7	-	-	-	-
49	-	-	-	-	-	-	-	-	1	-	-	-	-
SUB TOTAL	6					97	8		130				1
% MATURITY	6					94	7		93				
TOTAL	103						139						
SEX RATIO	42.6%						57.4%						

Table 11 (cont'd)

LOCALITY: Langara Spit

	MALE						FEMALE						
CONDITION	1	2	4	5	6	7	1	2	3	4	5	6	7
LENGTH (cm)													
26	1	-	-	-	-	-	-	-	-	-	-	-	-
27	0	-	-	-	-	-	2	-	-	-	-	-	-
28	1	-	-	-	-	-	0	-	-	-	-	-	-
29	1	-	-	-	-	-	0	-	-	-	-	-	-
30	1	-	-	-	-	-	0	1	-	-	-	-	-
31	5	-	-	-	-	-	0	1	-	-	-	-	-
32	3	-	-	-	-	1	3	1	-	-	-	-	-
33	4	-	-	-	-	1	3	0	1	-	-	-	-
34	2	-	-	-	-	2	2	0	0	-	-	-	-
35	2	-	-	-	-	8	0	3	3	-	-	-	-
36	0	-	-	-	-	9	0	0	6	-	-	-	-
37	1	-	-	-	-	22	0	1	7	-	-	-	-
38	-	-	-	-	-	27	0	1	7	-	-	-	-
39	-	-	-	-	-	10	1	-	6	-	-	-	-
40	-	-	-	-	-	7	-	-	13	-	-	-	-
41	-	-	-	-	-	6	-	-	12	-	-	-	-
42	-	-	-	-	-	-	-	-	12	-	-	-	-
43	-	-	-	-	-	-	-	-	12	-	-	-	-
44	-	-	-	-	-	-	-	-	7	-	-	-	-
45	-	-	-	-	-	1	-	-	5	-	-	-	-
46	-	-	-	-	-	-	-	-	5	-	-	-	-
47	-	-	-	-	-	-	-	-	2	-	-	-	-
SUB TOTAL	21					93	11	8	98				
% MATURITY	19					81	9	7	84				
TOTAL	114						117						
SEX RATIO	49.4%						50.6%						

Table 12. Oceanographic data for XBT stations off the west coast of Vancouver Is. (refer to Fig. 2), R/V G.B. REED, Nov. 8-28, 1982.

Station No.	Date (Yr/Mo/Da)	Time (PST)	Latitude	Longitude	Surface (°C)	Bottom (°C)	XBT Depth (M)
A	82/11/10	0215	48°40.0'	123°00.0'	9.8	12.5	53
B	82/11/10	0228	48°38.4'	125°01.8'	11.8	12.3	78
1	82/11/10	0241	48°36.5'	125°04.0'	11.1	9.5	94
2	82/11/10	0325	48°30.5'	125°10.5'	11.2	8.6	137
3	82/11/10	0410	48°24.0'	125°17.0'	11.8	8.5	110
4	82/11/10	0500	48°18.0'	125°24.0'	11.3	8.5	78
5	82/11/10	0542	48°11.5'	125°31.0'	11.6	8.5	110
6	82/11/10	0623	48°06.0'	125°37.5'	11.7	8.0	185
7	82/11/10	0642	48°03.0'	125°40.0'	11.5	5.0	490
8	82/11/12	1950	48°54.0'	125°35.0'	10.0	10.6	120
9	82/11/12	1912	48°50.0'	125°42.0'	11.6	11.6	55
10	82/11/12	1831	48°46.0'	125°50.5'	11.8	11.2	65
11	82/11/12	1741	48°41.0'	125°58.5'	11.9	9.5	98
12	82/11/12	1716	48°38.5'	126°04.0'	11.7	8.1	122
13	82/11/12	1634	48°35.5'	126°09.0'	11.4	7.7	245
14	82/11/12	1550	48°31.5'	126°19.5'	11.5	7.0	410
25	82/11/13	2111	49°55.2'	127°20.5'	10.5	10.6	64
26	82/11/13	2044	49°51.5'	127°25.0'	11.0	11.6	70
27	82/11/13	2011	49°47.0'	127°30.5'	11.2	8.5	82
28	82/11/13	1853	49°22.0'	127°38.0'	11.5	5.3	610
30	82/11/14	0235	50°21.5'	128°06.5'	11.0	10.7	93
31	82/11/14	0158	50°18.0'	128°12.5'	11.5	7.7	221
32	82/11/14	0043	50°13.0'	128°22.0'	11.7	3.4	1316

Table 13. Oceanographic data for XBT stations in Queen Charlotte Sd. and Hecate Strait, R/V G.B. REED, (refer to Fig. 3) Nov. 8-28, 1982.

Station No.	Date (Yr/Mo/Da)	Time (PST)	Latitude	Longitude	Surface (°C)	Bottom (°C)	XBT Depth (M)
3	82/11/14	2156	51°33.0'	128°13.0'	8.8	9.7	62
4	82/11/14	2107	51°29.5'	128°25.0'	9.4	7.2	180
5	82/11/14	1953	51°24.0'	128°42.5'	10.0	10.0	60
6	82/11/14	1838	51'18.5'	129°00.0'	11.0	7.3	215
7	82/11/14	1720	51°13.0'	129°17.0'	10.5	7.3	270
8	82/11/15	1114	51°07.0'	129°37.0'	10.3	6.2	373
9	82/11/15	1245	51°21.0'	129°49.0'	10.6	7.2	270
10	82/11/15	1406	51°35.0'	130°00.0'	10.1	7.0	255
11	82/11/15	1502	51°43.2'	129°50.0'	9.9	6.5	295
12	82/11/15	1603	51°52.6'	129°40.0'	10.0	12.5	700
13	82/11/15	1800	52°00.0'	129°30.0'	9.6	7.0	190
14	82/11/15	2055	52°00.3'	130°00.0'	9.2	7.1	118
15	82/11/18	1819	52°00.0'	130°30.0'	8.8	5.8	375
16	82/11/18	1942	52°10.0'	130°22.0'	8.7	5.7	390
17	82/11/18	2057	52°20.0'	130°15.0'	9.5	5.9	376
18	82/11/18	2215	52°30.0'	130°07.0'	9.5	5.9	284
19	82/11/18	2321	52°40.0'	130°09.0'	9.2	6.4	231
20	82/11/19	0026	52°50.0'	130°10.5'	9.3	6.2	228
21	82/11/19	0128	53°00.0'	130°12.0'	9.5	6.1	230
22	82/11/19	0251	53°09.0'	130°27.5'	9.3	7.0	198
23	82/11/19	0426	53°20.0'	130°45.5'	8.7	7.8	145
H2	82/11/19	0548	53°30.0'	130°57.5'	9.0	8.6	89
H3	82/11/19	0705	53°25.5'	131°14.5'	8.2	8.4	38
H4	82/11/19	0821	53°21.0'	131°32.0'	8.0	8.0	40

Table 14. Oceanographic data for XBT stations off the west coast of the Queen Charlotte Islands, R/V G.B. REED, Nov. 8-28, 1982 (refer to Fig. 3).

Station No.	Date (Yr/Mo/Da)	Time (PST)	Latitude	Longitude	Surface (°C)	Bottom (°C)	XBT Depth (M)
QCI1	82/11/21	1600	52°40.5'	132°04.1'	8.4	7.5	203
QCI2	82/11/21	1611	52°40.5'	132°04.8'	8.4	5.3	520
QCI3	82/11/21	1931	53°04.5'	132°36.0'	8.5	5.9	190
QCI4	82/11/21	1944	53°04.7'	132°39.5'	8.3	6.2	395
DE1	82/11/24	1355	54°10.9'	133°47.6'	8.2	6.2	358
DE2	82/11/24	1410	54°11.2'	133°43.3'	8.6	6.5	227
DE3	82/11/24	1530	54°15.1'	133°18.2'	8.4	6.9	470

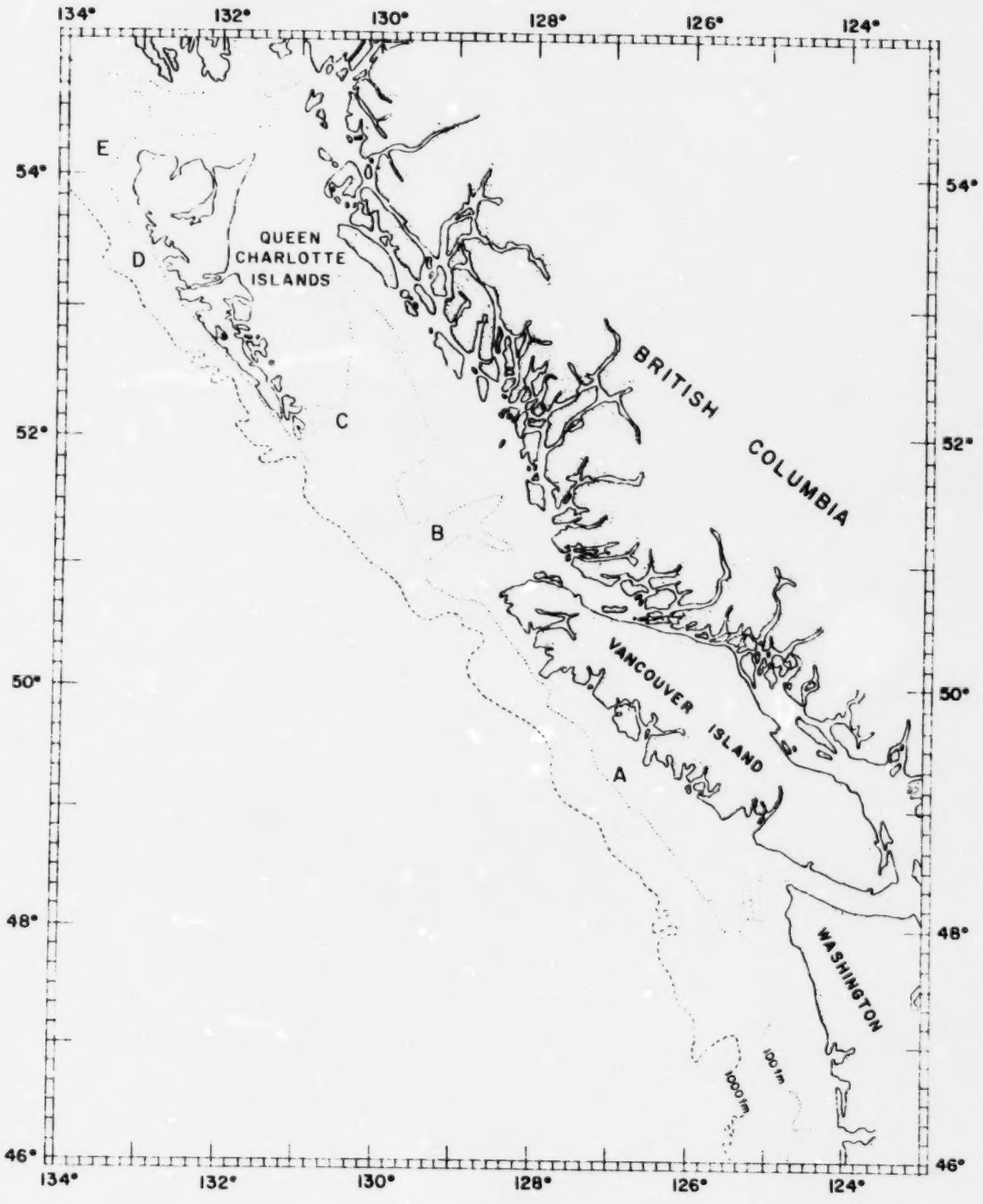

Fig. 1. Sebastes alutus stocks; A - Southwest Vancouver Island, B - Goose Island Gully, C - Moresby Gully, D - Rennell Sound, E - Langara Spit.

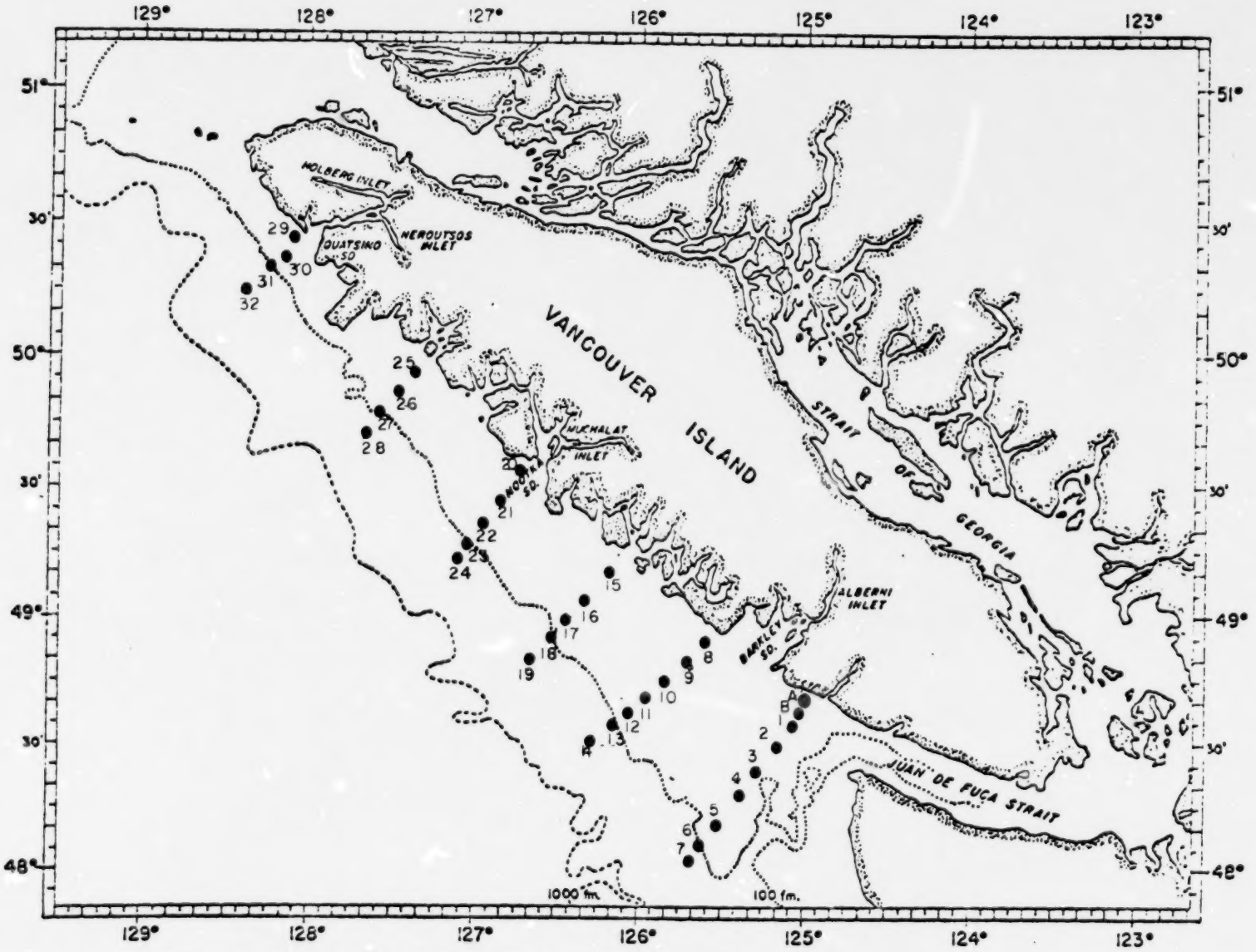

Fig. 2. Standard oceanographic stations off Vancouver Island.

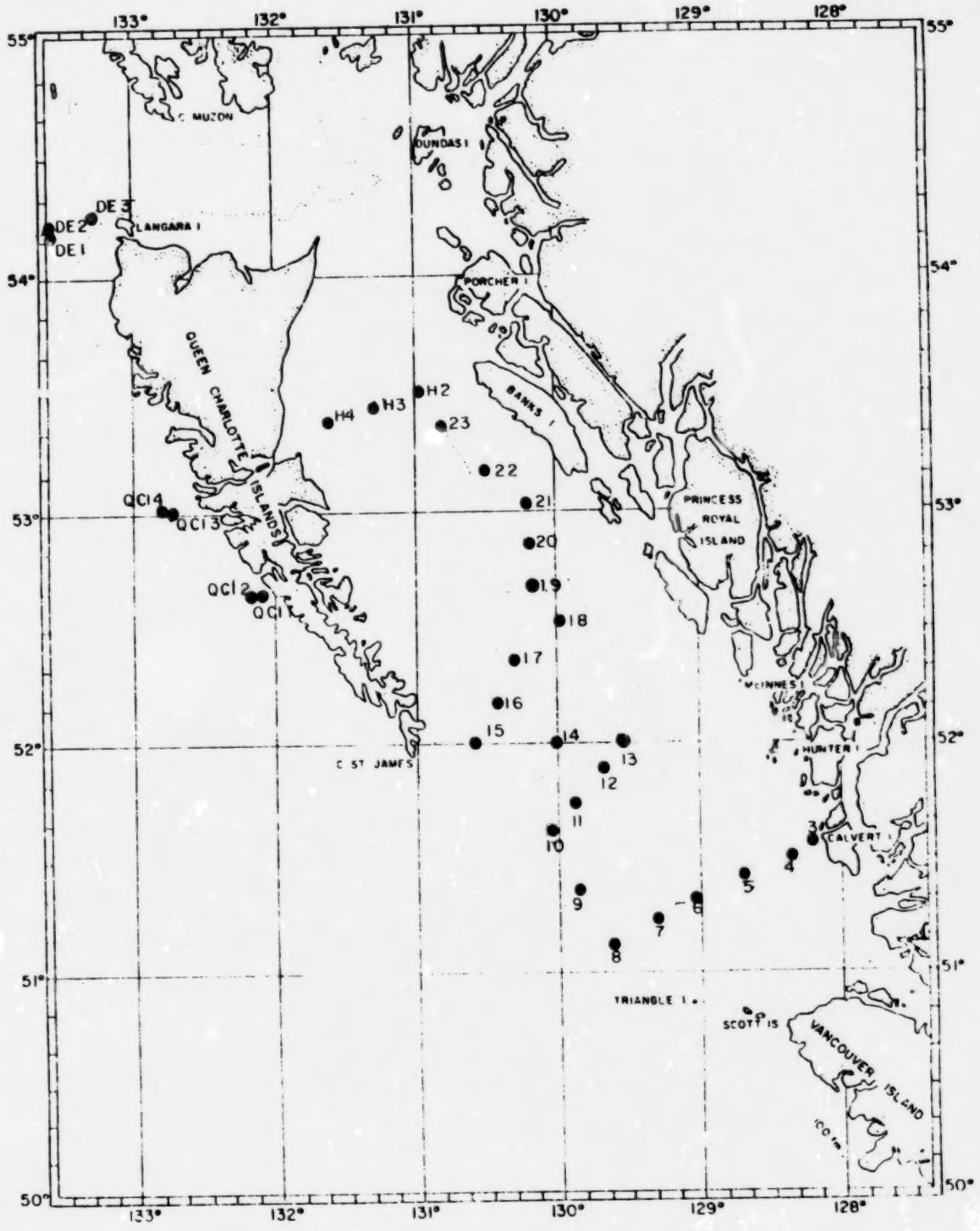

Fig. 3. Standard oceanographic stations in Queen Charlotte Sound, Hecate Strait, Dixon Entrance and the Queen Charlotte Islands.

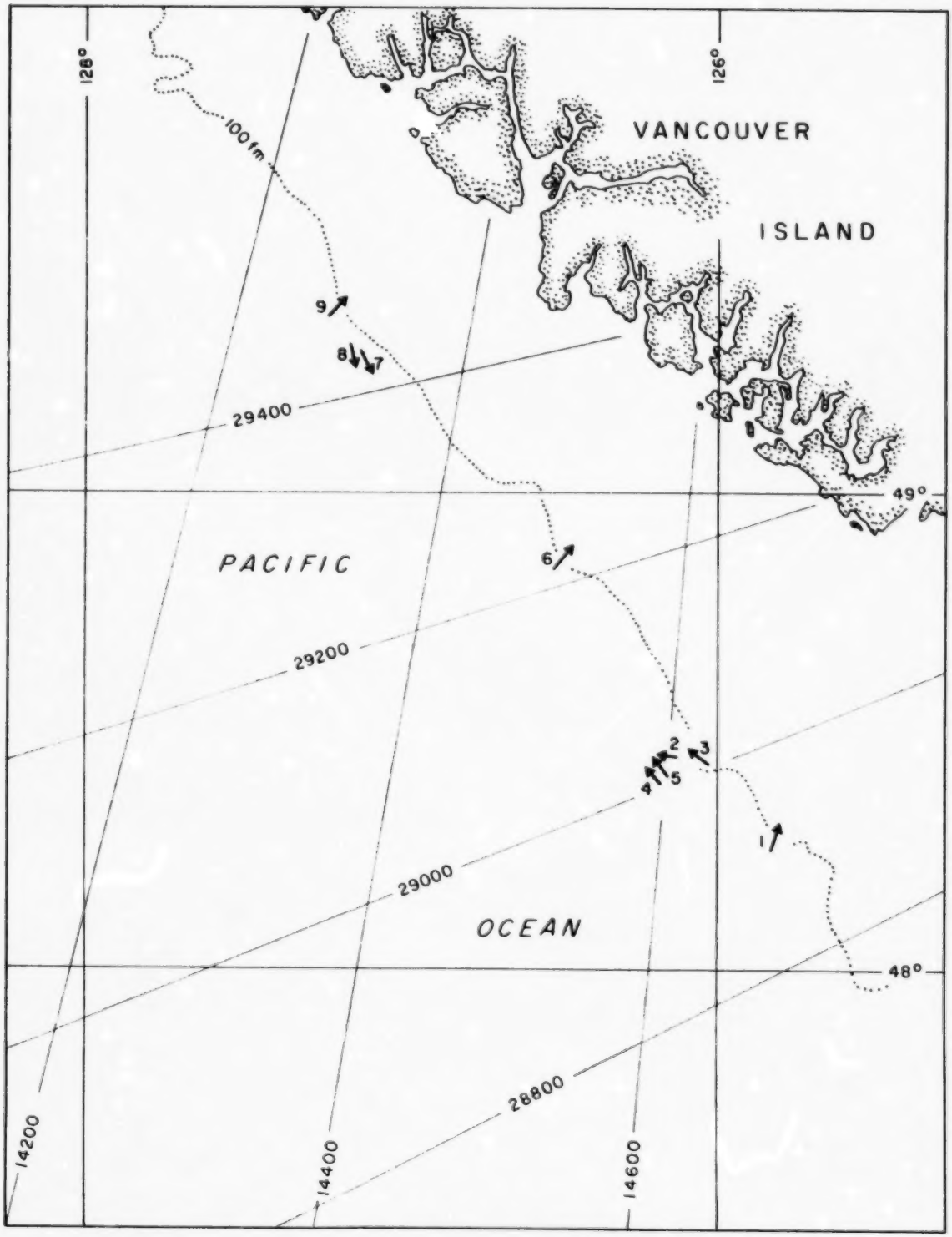

Fig. 4. Locations of trawl stations off Vancouver Island, R/V G.B. REED November 8-28, 1982.

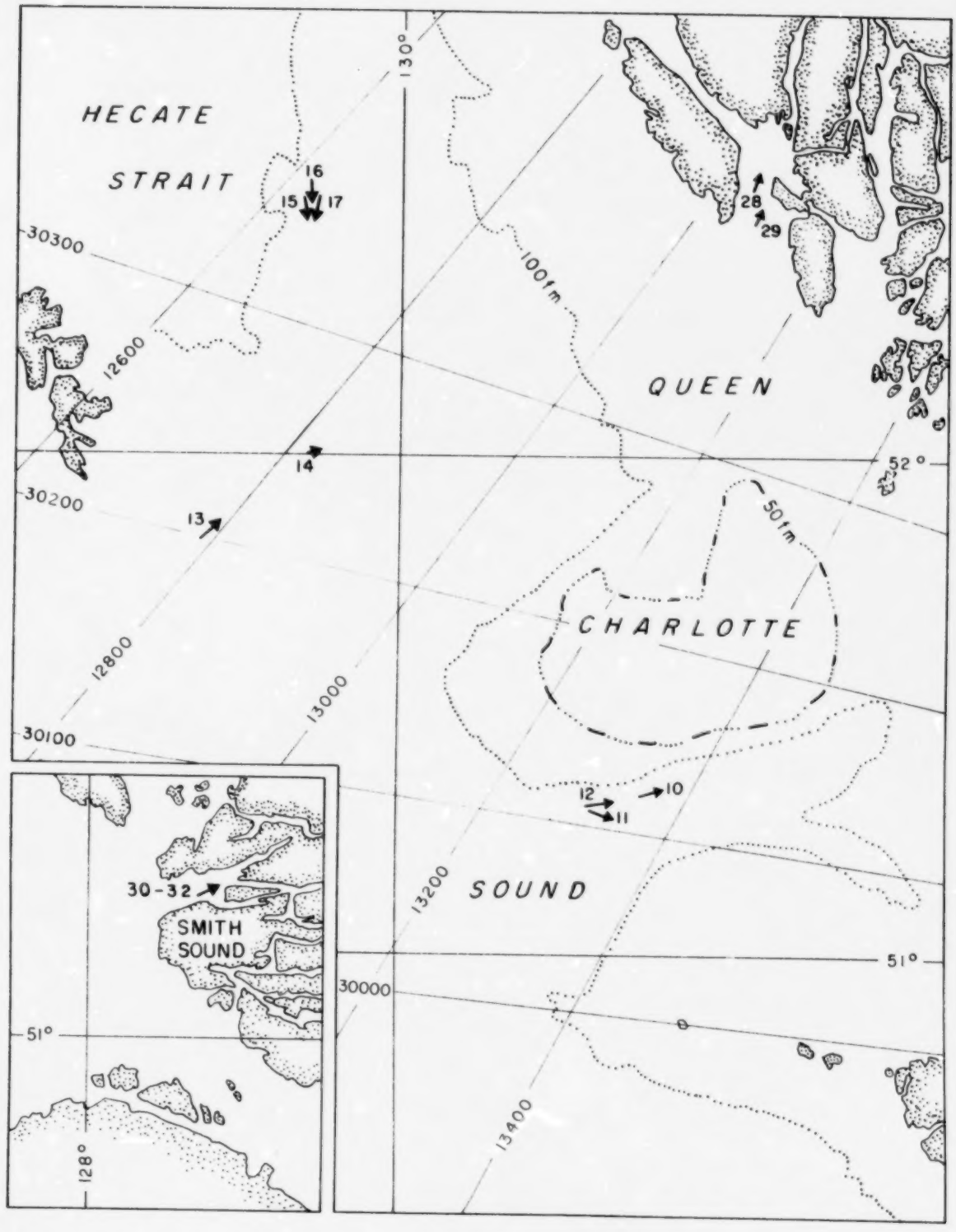

Fig. 5. Location of trawl stations in Queen Charlotte Sound and Hecate Strait, R/V G.B. REED November 8-28, 1982.

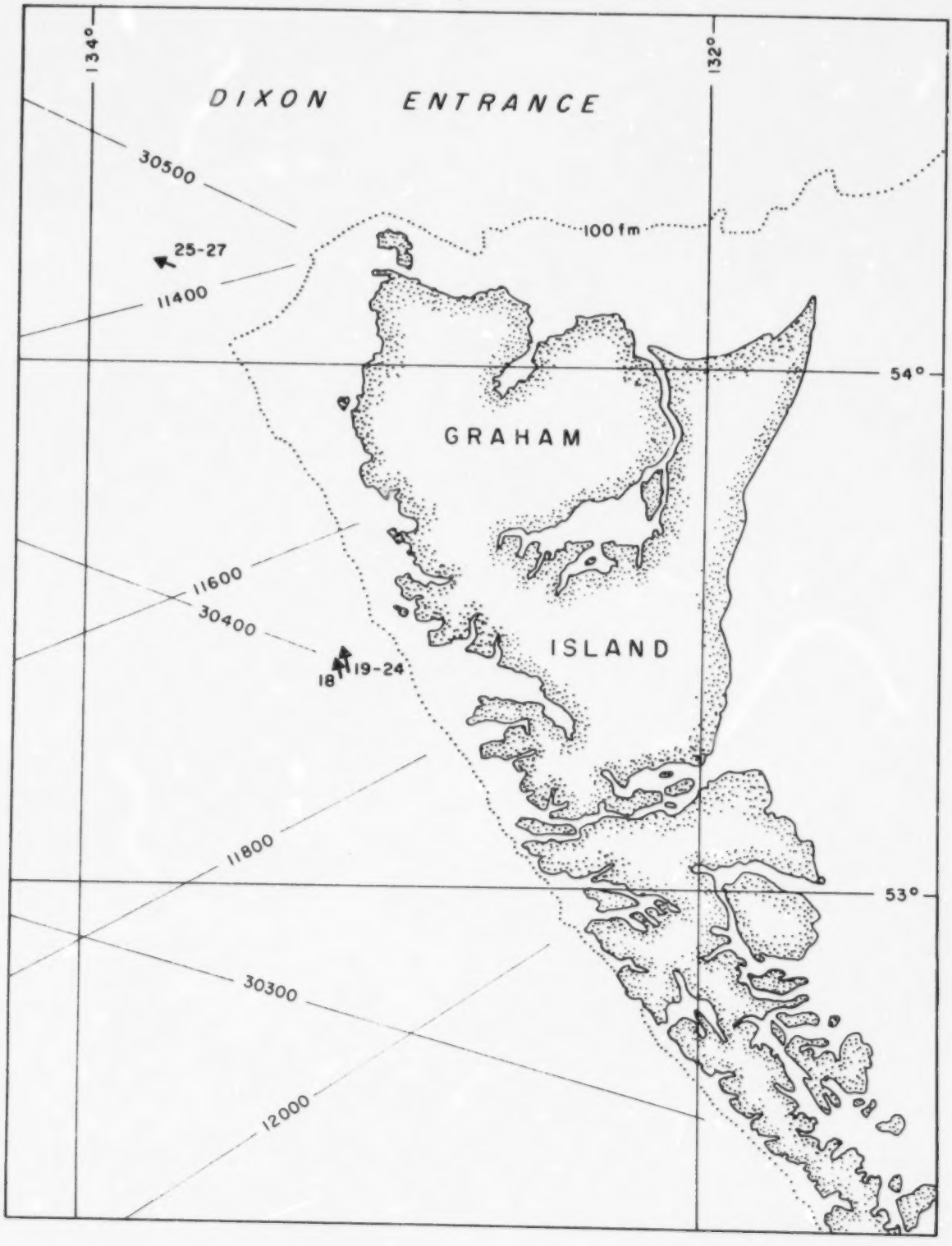

Fig. 6. Location of trawl stations off the Queen Charlotte Islands and Langara Spit, R/V G.B. REED, November 8-28, 1982.

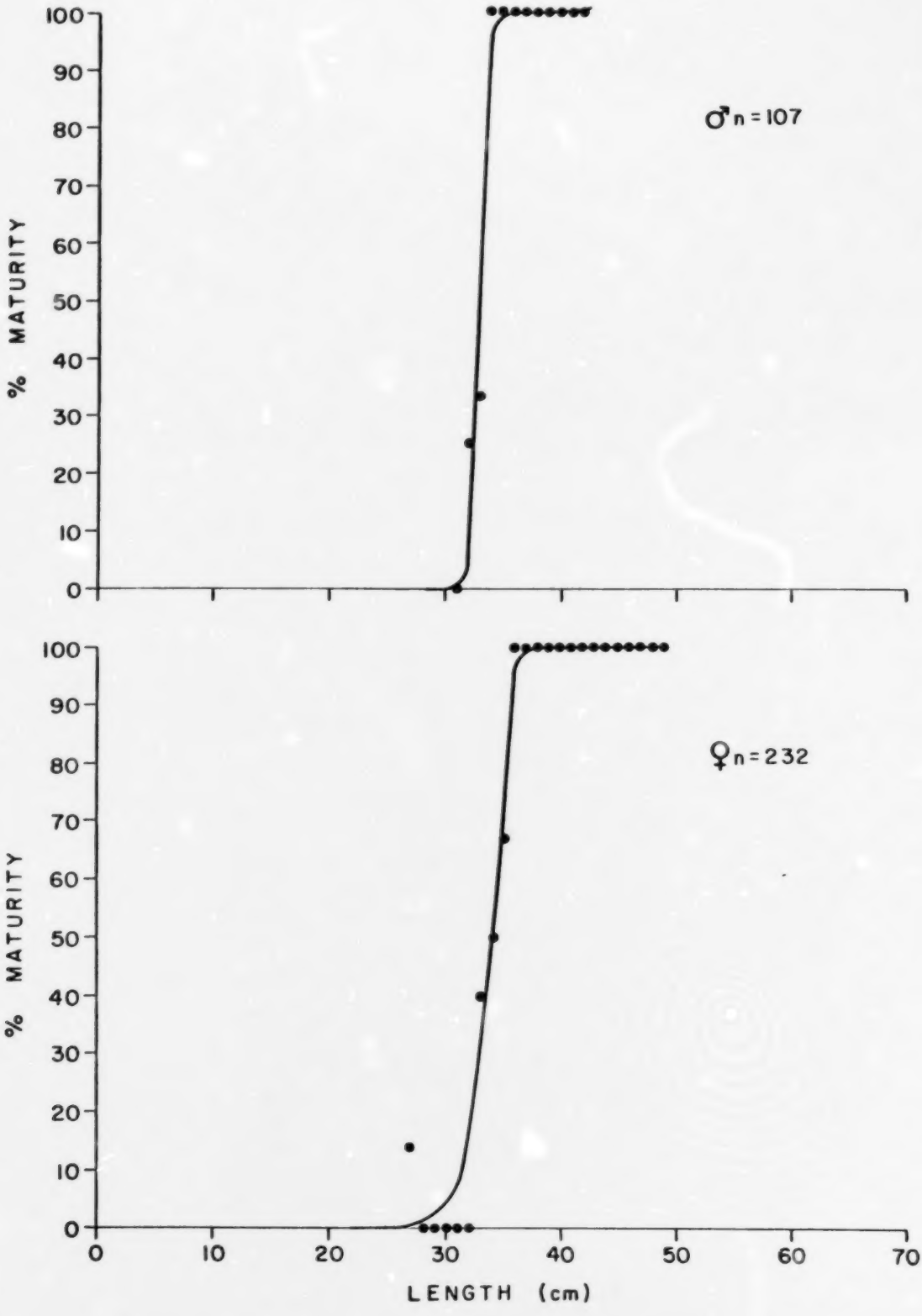

Fig. 7. Length-maturity ogive for S. alutus off Vancouver Island, November 1982, by sex.

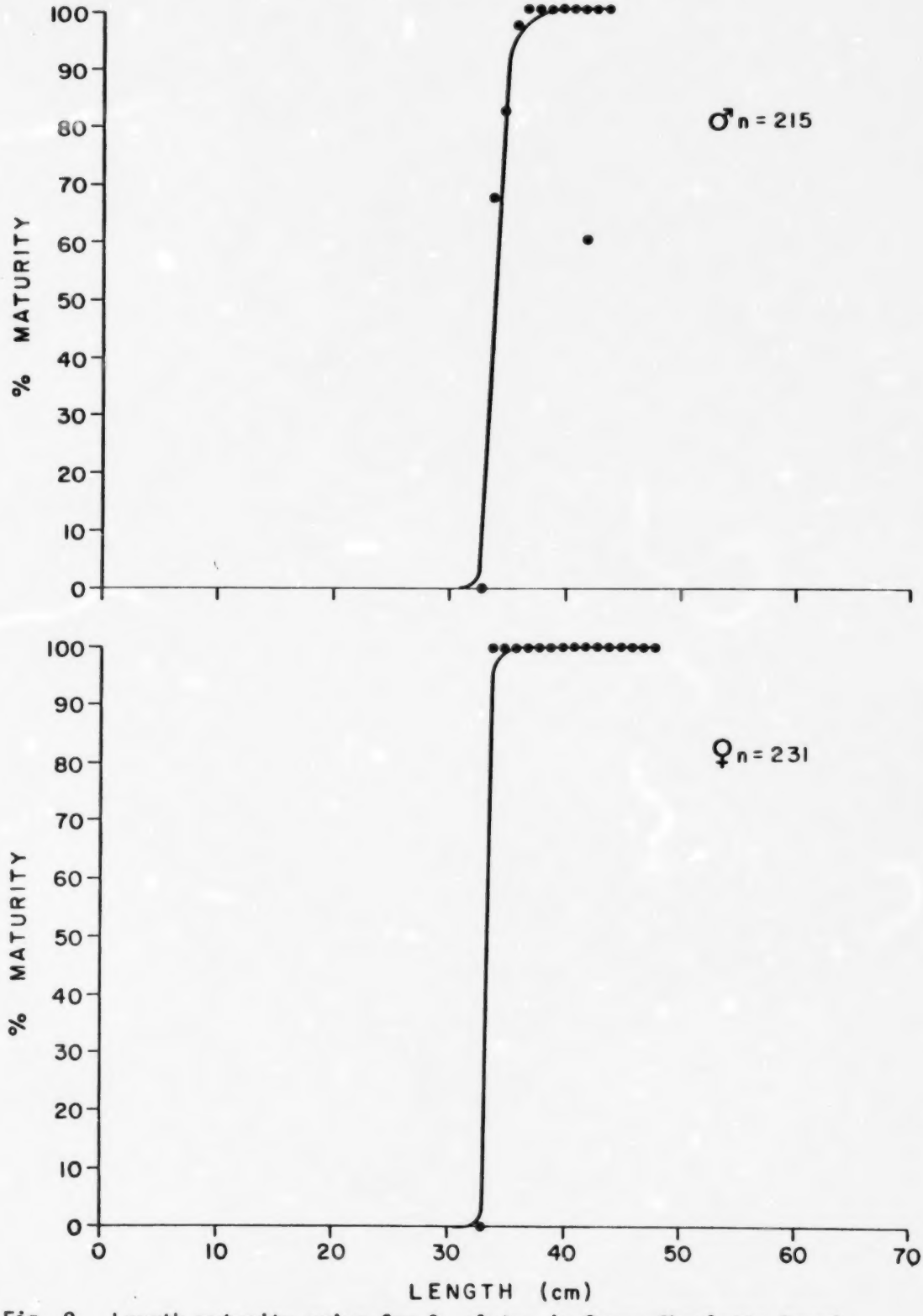

Fig. 8. Length-maturity ogive for S. alutus in Queen Charlotte Sound, November 1982, by sex.

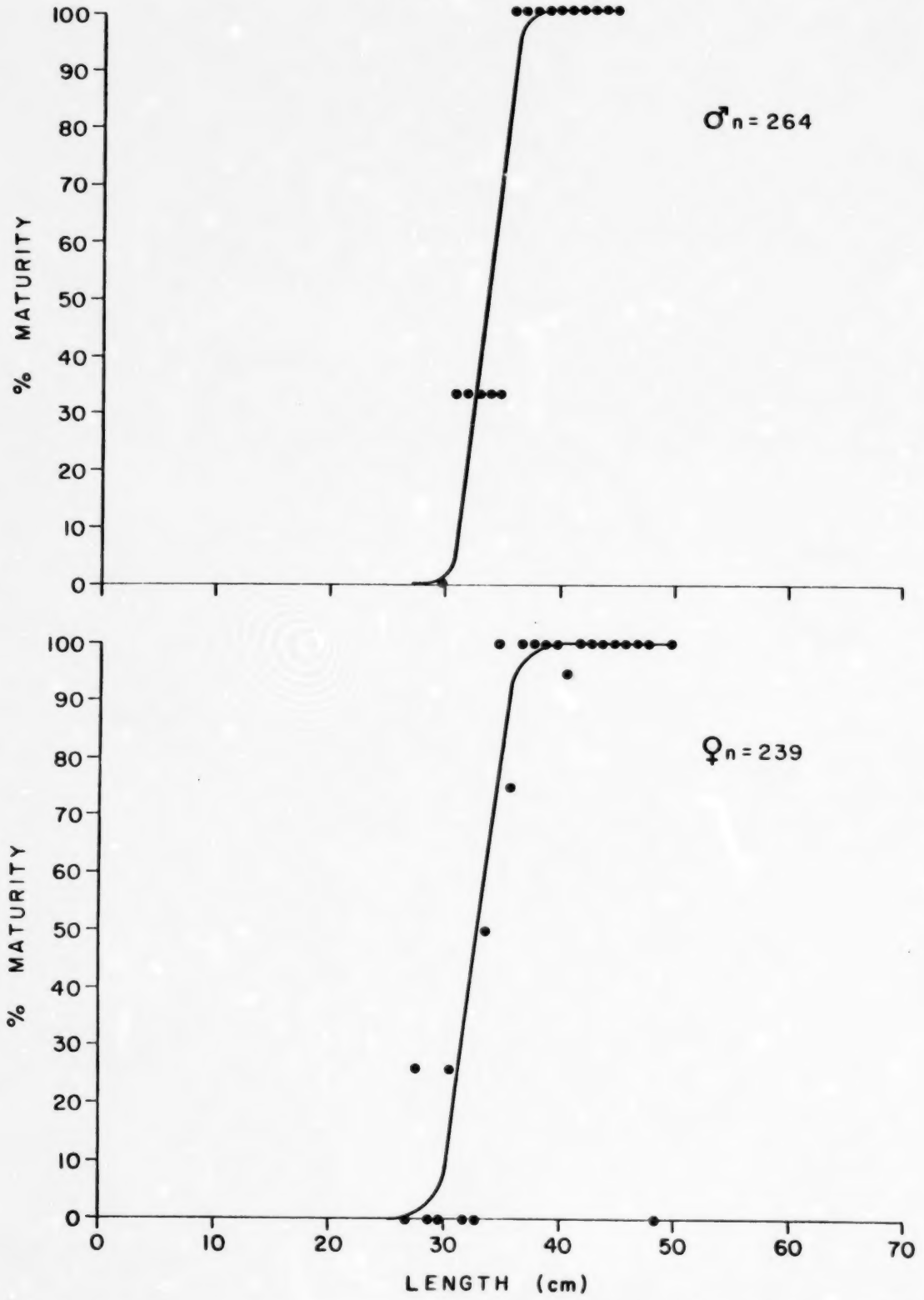

Fig. 9. Length-maturity ogive for S. alutus in Moresby Gully, November 1982, by sex.

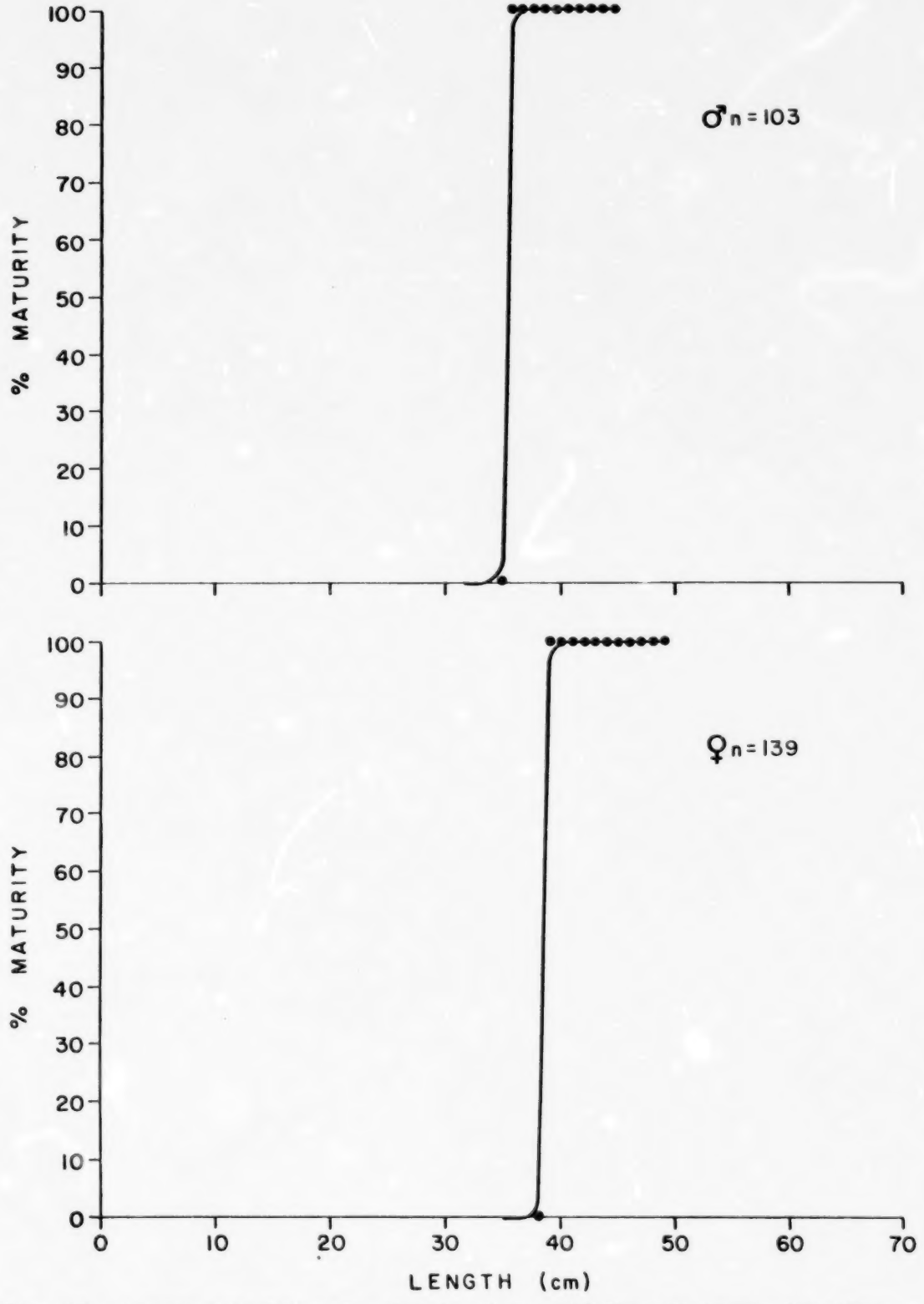

Fig. 10. Length-maturity ogive for S. alutus off Rennell Sound, November 1982, by sex.

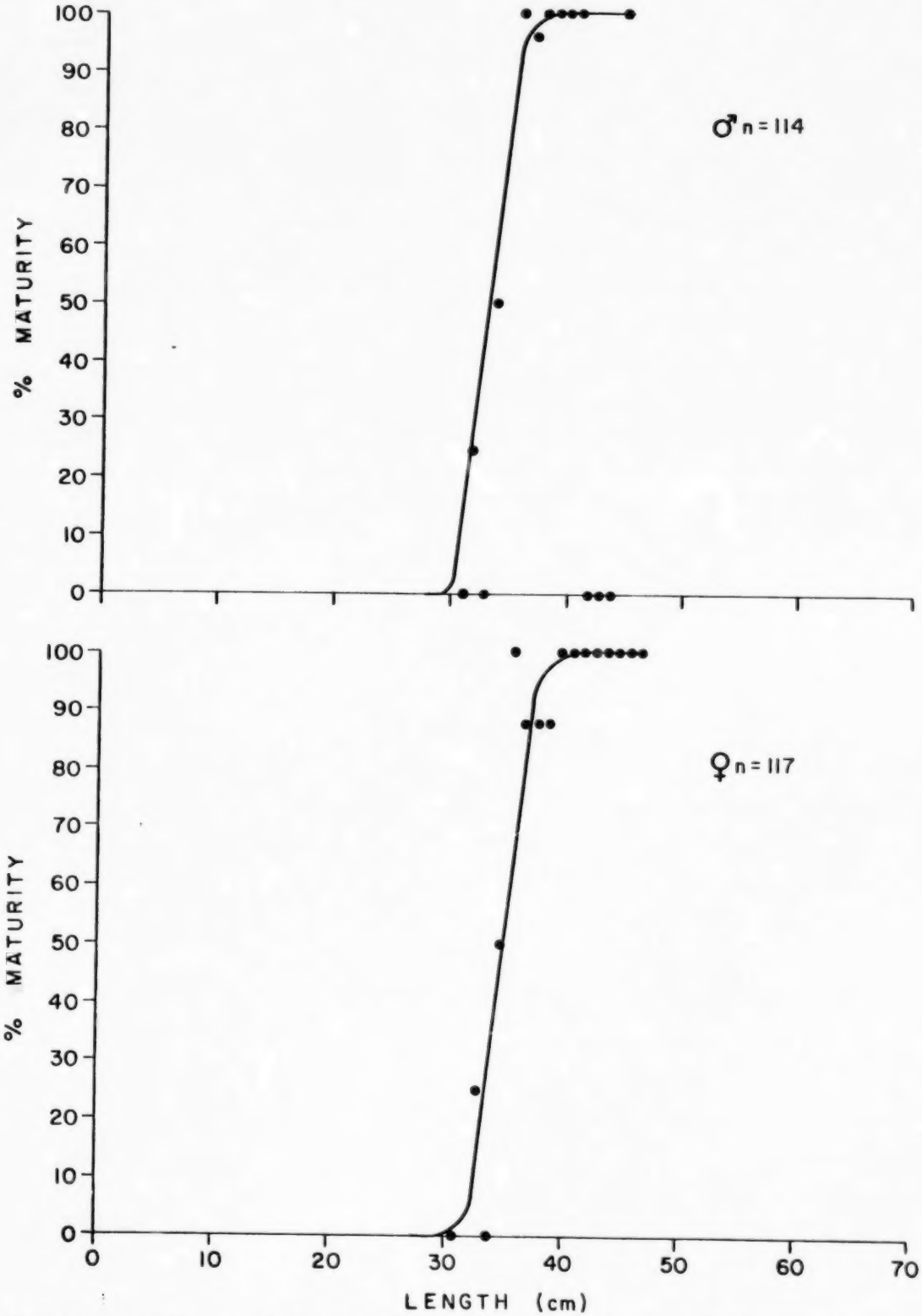

Fig. 11. Length-maturity ogive for S. alutus off Langara Spit, November 1982, by sex.

APPENDIX TABLE 1 ROCKFISH FECUNDITY CRUISE, R/V G.B. REED, NOVEMBER 8-28,1982

HAUL NUMBER	1	2	3	4
DATE	NOV 10	NOV 11	NOV 11	NOV 11
AREA (MAJOR, MINOR)	3C,23	3C,23	3C,23	3C,23
START TIME (PST)	10:23	8:31	10:24	12:37
DURATION (MIN)	23	29	28	30
START N. LAT. (DEG)	48	48	48	48
(MIN)	16.2	27.0	25.5	25.3
W. LONG (DEG)	125	126	126	126
(MIN)	48.1	6.6	7.4	7.4
START LORAN-C X	14686.8	14613.2	14610.9	14611.0
Y	28911.8	29020.3	29011.4	29010.1
FINISH N. LAT. (DEG)	48	48	48	48
(MIN)	17.2	28.2	27.1	26.5
W. LONG (DEG)	125	126	126	126
(MIN)	48.6	7.5	8.3	8.7
FINISH LORAN-C X	14684.6	14609.1	14606.7	14605.5
Y	28919.7	29030.1	29023.9	29020.5
HAUL DISTANCE (KM)	1.9	2.4	3.1	2.8
(N MI)	1.0	1.3	1.7	1.5
DIRECTION (DEG.TRUE)	338	345	337	329
BOTTOM DEPTH (M)	194- 183	236- 227	258- 267	276- 278
(FM)	106- 100	129- 124	141- 146	151- 152
MODAL DEPTH (M)	..	..	..	..
WATER TEMP. (DEG C)	11.5	0.0	0.0	0.0
GEAR TYPE	21	21	21	21
TIDE	EBB	FLOOD	SLACK	EBB
TOTAL CATCH (KG)	18143	383	442	382
REMARKS	USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	1	2	3	4
DATE	NOV 10	NOV 11	NOV 11	NOV 11
AREA (MAJOR, MINOR)	3C,23	3C,23	3C,23	3C,23
ARROWTOOTH FLOUNDER	..	14	23	..
DOVER SOLE	..	..	..	..
FLATHEAD SOLE	..	..	..	..
PACIFIC HALIBUT	..	14	..	..
PETRALE SOLE	..	5	18	23
OTHER FLATFISH	..	..	..	..
S. ALEUTIANUS	..	..	..	..
S. ALUTUS	..	27	136	159
S. BABCOCKI	..	..	..	..
S. BOREALIS	..	..	..	..
S. BREVISPINIS	..	..	..	..
S. CRAMERI	..	..	..	..
S. DIPLOPROA	..	5	3	..
S. ENTOMELAS	..	..	..	..
S. PRORIGER	..	..	..	..
S. REEDI	..	..	..	..
S. ZACENTRUS	..	3	3	..
SEB. ALASCANUS	..	..	..	..
OTHER ROCKFISH	..	..	..	..
LINGCOD	..	68	68	55
PACIFIC COD	..	3	..	5
PACIFIC HAKE	..	54	5	27
SABLEFISH	..	136	181	113
WALLEYE POLLOCK	..	..	..	..
WOLF EEL	..	..	..	..
OTHER ROUNDFISH	..	..	..	..
RATFISH	..	..	5	..
SKATES	..	..	..	..
SPINY DOGFISH	18143	54	..	..
OTHER SELACHII	..	..	..	..
PINK SHRIMP	..	..	..	..
SIDESTRIPE SHRIMP	..	..	..	..
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	18143	383	442	382

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER		5	6	7	8
DATE		NOV 11	NOV 12	NOV 13	NOV 13
AREA (MAJOR, MINOR)		3C,23	3C,24	3D,25	3D,25
START TIME	(PST)	14:18	12:24	9:45	12:17
DURATION	(MIN)	44	30	30	30
START N. LAT.	(DEG)	48	48	49	49
	(MIN)	25.0	50.7	17.7	18.9
W. LONG	(DEG)	126	126	127	127
	(MIN)	7.6	32.5	9.1	10.3
START LORAN-C	X	14610.4	14493.8	14305.3	14298.1
	Y	29008.4	29221.7	29440.0	29448.8
FINISH N. LAT.	(DEG)	48	48	49	49
	(MIN)	27.1	49.4	16.9	17.5
W. LONG	(DEG)	126	126	127	127
	(MIN)	9.3	32.0	7.9	9.4
FINISH LORAN-C	X	14602.8	14497.1	14311.7	14304.3
	Y	29025.6	29212.2	29433.9	29438.0
HAUL DISTANCE	(KM)	4.4	2.4	2.0	2.8
	(N MI)	2.4	1.3	1.1	1.5
DIRECTION (DEG.TRUE)		330	151	147	137
BOTTOM DEPTH	(M)	294- 311	240- 243	263- 262	256- 293
	(FM)	161- 170	131- 133	144- 143	140- 160
MODAL DEPTH	(M)	..	..	..	..
WATER TEMP.	(DEG C)	0.0	0.0	8.3	0.0
GEAR TYPE		21	21	21	21
TIDE		SLACK	EBB	FLOOD	EBB
TOTAL CATCH	(KG)	1697	2268	1135	1123
REMARKS		USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	5	6	7	8
DATE	NOV 11	NOV 12	NOV 13	NOV 13
AREA (MAJOR, MINOR)	3C,23	3C,24	3D,25	3D,25
ARROWTOOTH FLOUNDER	85	..	..	..
DOVER SOLE	..	..	..	..
FLATHEAD SOLE	..	..	..	..
PACIFIC HALIBUT	..	..	..	..
PETRALE SOLE	..	..	..	..
OTHER FLATFISH	..	..	..	..
S. ALEUTIANUS	..	..	..	..
S. ALUTUS	979	2155	34	34
S. BABCOCKI	..	..	..	..
S. BOREALIS	..	..	..	..
S. BREVISPINIS	..	..	..	..
S. CRAMERI	..	..	..	..
S. DIPLOPROA	298	..	964	964
S. ENTOMELAS	..	..	..	..
S. PRORIGER	..	113	..	..
S. REEDI	..	..	..	..
S. ZACENTRUS	..	..	..	..
SEB. ALASCANUS	..	..	..	..
OTHER ROCKFISH	..	..	..	..
LINGCOD	..	..	57	34
PACIFIC COD	..	..	..	..
PACIFIC HAKE	25	..	..	..
SABLEFISH	298	..	57	68
WALLEYE POLLOCK	12	..	..	..
WOLF EEL	..	..	..	..
OTHER ROUNDFISH	..	..	..	..
RATFISH	..	..	..	..
SKATES	..	..	..	..
SPINY DOGFISH	..	..	23	23
OTHER SELACHII	..	..	..	..
PINK SHRIMP	..	..	..	..
SIDESTRIPE SHRIMP	..	..	..	..
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	1697	2268	1135	1123

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER		9	10	11	12
DATE		NOV 13	NOV 14	NOV 14	NOV 15
AREA (MAJOR, MINOR)		3D,25	5B,08	5B,08	5B,08
START TIME	(PST)	14:53	10:35	14:23	8:25
DURATION	(MIN)	30	30	30	30
START N. LAT.	(DEG)	49	51	51	51
	(MIN)	20.6	20.5	17.5	17.5
W. LONG	(DEG)	127	129	129	129
	(MIN)	12.9	11.7	22.5	24.1
START LORAN-C	X	14283.9	13339.3	13301.5	13293.9
	Y	29461.8	30124.8	30106.7	30105.0
FINISH N. LAT.	(DEG)	49	51	51	51
	(MIN)	21.9	20.7	16.9	17.8
W. LONG	(DEG)	127	129	129	129
	(MIN)	14.5	3.5	20.5	21.8
FINISH LORAN-C	X	14274.7	13378.5	13313.9	13303.4
	Y	29471.4	30129.7	30104.0	30108.3
HAUL DISTANCE	(KM)	3.1	9.4	2.6	2.8
	(N MI)	1.7	5.1	1.4	1.5
DIRECTION (DEG.TRUE)		313	66	89	84
BOTTOM DEPTH	(M)	291- 291	232- 231	287- 289	272- 283
	(FM)	159- 159	127- 126	157- 158	149- 155
MODAL DEPTH	(M)	..	..	..	..
WATER TEMP.	(DEG C)	9.8	7.8	0.0	0.0
GEAR TYPE		21	21	21	21
TIDE		EBB	FLOOD	EBB	FLOOD
TOTAL CATCH	(KG)	0	646	861	1078
REMARKS		USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	9	10	11	12
DATE	NOV 13	NOV 14	NOV 14	NOV 15
AREA (MAJOR, MINOR)	3D,25	5B,08	5B,08	5B,08
ARROWTOOTH FLOUNDER	..	476	45	454
DOVER SOLE	..	..	363	227
FLATHEAD SOLE	..	..	..	..
PACIFIC HALIBUT	..	..	..	..
PETRALE SOLE	..	..	..	..
OTHER FLATFISH	..	..	..	..
S. ALEUTIANUS	..	..	45	113
S. ALUTUS	..	34	363	284
S. BABCOCKI	..	..	..	..
S. BOREALIS	..	..	..	..
S. BREVISPINIS	..	..	..	..
S. CRAMERI	..	..	..	..
S. DIPLOPROA	..	..	..	..
S. ENTOMELAS	..	..	..	..
S. PRORIGER	..	..	..	..
S. REEDI	..	..	..	..
S. ZACENTRUS	..	..	..	..
SEB. ALASCANUS	..	..	..	..
OTHER ROCKFISH	..	..	..	..
LINGCOD	..	..	..	..
PACIFIC COD	..	..	..	..
PACIFIC HAKE	..	..	..	..
SABLEFISH	..	..	..	..
WALLEYE POLLOCK	..	34	..	..
WOLF EEL	..	..	..	..
OTHER ROUNDFISH	..	..	..	..
RATFISH	..	..	..	..
SKATES	..	..	..	..
SPINY DOGFISH	..	102	45	..
OTHER SELACHII	..	..	..	..
PINK SHRIMP	..	..	..	..
SIDESTRIPE SHRIMP	..	..	..	..
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	0	646	861	1078

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	13	14	15	16
DATE	NOV 18	NOV 18	NOV 20	NOV 20
AREA (MAJOR, MINOR)	5B,08	5B,08	5C,02	5C,02
START TIME (PST)	9:07	15:56	8:54	10:48
DURATION (MIN)	30	5	30	45
START N. LAT. (DEG)	51	51	52	52
(MIN)	49.5	59.6	30.9	31.2
W. LONG (DEG)	130	130	130	130
(MIN)	39.3	18.1	18.6	18.4
START LORAN-C X	12788.6	12821.9	12627.8	12626.8
Y	30196.6	30243.7	30348.1	30349.2
FINISH N. LAT. (DEG)	51	51	52	52
(MIN)	50.9	59.6	29.5	29.3
W. LONG (DEG)	130	130	130	130
(MIN)	38.3	18.2	19.9	20.1
FINISH LORAN-C X	12784.9	12821.4	12631.1	12631.4
Y	30202.1	30243.6	30342.9	30342.1
HAUL DISTANCE (KM)	2.8	1.1	3.0	4.1
(N MI)	1.5	0.6	1.6	2.2
DIRECTION (DEG.TRUE)	10	215	207	208
BOTTOM DEPTH (M)	351- 311	347- 347	252- 265	254- 262
(FM)	192- 170	190- 190	138- 145	139- 143
MODAL DEPTH (M)	..	..	..	..
WATER TEMP. (DEG C)	6.7	0.0	0.0	7.2
GEAR TYPE	21	21	21	21
TIDE	SLACK	EBB	EBB	FLOOD
TOTAL CATCH (KG)	363	105	278	441
REMARKS	USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	13	14	15	16
DATE	NOV 18	NOV 18	NOV 20	NOV 20
AREA (MAJOR, MINOR)	5B,08	5B,08	5C,02	5C,02
ARROWTOOTH FLOUNDER	73	14	..	11
DOVER SOLE	18	..	23	45
FLATHEAD SOLE	..	..	..	..
PACIFIC HALIBUT	..	..	..	..
PETRALE SOLE	..	..	..	..
OTHER FLATFISH	..	..	..	..
S. ALEUTIANUS	7	..	..	..
S. ALUTUS	254	68	227	318
S. BABCOCKI	4	9	5	7
S. BOREALIS	..	..	..	..
S. BREVISPINIS	..	..	..	..
S. CRAMERI	..	..	..	..
S. DIPLOPROA	..	..	..	..
S. ENTOMELAS	..	..	..	..
S. PRORIGER	..	..	..	..
S. REEDI	..	..	..	..
S. ZACENTRUS	..	..	..	..
SEB. ALASCANUS	..	..	5	..
OTHER ROCKFISH	..	..	..	..
LINGCOD	..	..	..	23
PACIFIC COD	..	..	5	..
PACIFIC HAKE	..	..	..	..
SABLEFISH	..	..	3	5
WALLEYE POLLOCK	..	14	5	2
WOLF EEL	7	..	..	18
OTHER ROUNDFISH	..	..	..	..
RATFISH	..	..	..	1
SKATES	..	..	..	..
SPINY DOGFISH	..	..	5	11
OTHER SELACHII	..	..	..	..
PINK SHRIMP	..	..	..	..
SIDESTRIPE SHRIMP	..	..	..	..
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	363	105	278	441

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER		17	18	19	20
DATE		NOV 20	NOV 22	NOV 22	NOV 22
AREA (MAJOR, MINOR)		5C,02	5E,31	5E,31	5E,31
START TIME	(PST)	13:11	9:13	11:55	13:23
DURATION	(MIN)	43	25	20	19
START N. LAT.	(DEG)	52	53	53	53
	(MIN)	30.9	25.4	25.5	25.7
W. LONG	(DEG)	130	133	133	133
	(MIN)	18.6	9.1	9.2	9.4
START LORAN-C	X	12627.8	11706.7	11705.9	11704.3
	Y	30348.1	30397.4	30397.6	30397.0
FINISH N. LAT.	(DEG)	52	53	53	53
	(MIN)	29.1	26.5	26.7	26.8
W. LONG	(DEG)	130	133	133	133
	(MIN)	20.3	9.0	8.9	9.7
FINISH LORAN-C	X	12631.8	11699.9	11698.9	11696.7
	Y	30341.3	30400.0	30400.6	30400.4
HAUL DISTANCE	(KM)	3.9	2.0	2.2	2.0
	(N MI)	2.1	1.1	1.2	1.1
DIRECTION (DEG.TRUE)		200	352	5	335
BOTTOM DEPTH	(M)	260- 259	252- 254	247- 315	386- 353
	(FM)	142- 142	138- 139	135- 172	211- 193
MODAL DEPTH	(M)	..	..	..	..
WATER TEMP.	(DEG C)	0.0	0.0	0.0	0.0
GEAR TYPE		21	21	21	21
TIDE		FLOOD	EBB	SLACK	FLOOD
TOTAL CATCH	(KG)	342	2790	8	163
REMARKS		USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	17	18	19	20
DATE	NOV 20	NOV 22	NOV 22	NOV 22
AREA (MAJOR, MINOR)	5C,02	5E,31	5E,31	5E,31
ARROWTOOTH FLOUNDER	18	..	..	..
DOVER SOLE	32	..	1	27
FLATHEAD SOLE	..	..	..	..
PACIFIC HALIBUT	..	..	..	..
PETRALE SOLE	..	..	..	..
OTHER FLATFISH	..	..	1	..
S. ALEUTIANUS	..	..	..	45
S. ALUTUS	249	136	5	68
S. BABCOCKI	23	..	..	..
S. BOREALIS	..	..	..	23
S. BREVISPINIS	..	..	1	..
S. CRAMERI	..	..	..	..
S. DIPLOPROA	..	..	..	..
S. ENTOMELAS	..	..	..	..
S. PRORIGER	..	68	..	..
S. REEDI	..	2586	..	..
S. ZACENTRUS	..	..	..	..
SEB. ALASCANUS	11	..	..	..
OTHER ROCKFISH	..	..	..	..
LINGCOD	..	..	..	..
PACIFIC COD	..	..	..	..
PACIFIC HAKE	..	..	..	..
SABLEFISH	..	..	..	..
WALLEYE POLLOCK	..	..	..	..
WOLF EEL	..	..	..	..
OTHER ROUNDFISH	..	..	..	..
RATFISH	..	..	..	..
SKATES	..	..	..	..
SPINY DOGFISH	9	..	..	..
OTHER SELACHII	..	..	..	..
PINK SHRIMP	..	..	..	..
SIDESTRIPE SHRIMP	..	..	..	..
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	342	2790	8	163

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER		21	22	23	24
DATE		NOV 22	NOV 23	NOV 23	NOV 23
AREA (MAJOR, MINOR)		5E,31	5E,31	5E,31	5E,31
START TIME	(PST)	15:02	8:42	10:18	12:23
DURATION	(MIN)	24	24	25	21
START N. LAT.	(DEG)	53	53	53	53
	(MIN)	25.8	25.6	25.0	25.5
W. LONG	(DEG)	133	133	133	133
	(MIN)	9.5	9.5	8.5	9.4
START LORAN-C	X	11703.4	11704.7	11710.4	11705.5
	Y	30398.2	30397.7	30396.8	30397.5
FINISH N. LAT.	(DEG)	53	53	53	53
	(MIN)	27.1	27.0	26.3	26.8
W. LONG	(DEG)	133	133	133	133
	(MIN)	9.7	9.6	8.6	9.4
FINISH LORAN-C	X	11694.8	11695.6	11701.0	11697.3
	Y	30401.1	30400.9	30399.8	30400.5
HAUL DISTANCE	(KM)	2.4	2.6	2.4	2.4
	(N MI)	1.3	1.4	1.3	1.3
DIRECTION (DEG.TRUE)		350	345	353	345
BOTTOM DEPTH	(M)	369- 371	399- 377	227- 251	315- 331
	(FM)	202- 203	218- 206	124- 137	172- 181
MODAL DEPTH	(M)	..	..	..	..
WATER TEMP. (DEG C)		0.0	6.1	6.1	0.0
GEAR TYPE		21	21	21	21
TIDE		FLOOD	EBB	EBB	SLACK
TOTAL CATCH	(KG)	214	61	2132	995
REMARKS		USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	21	22	23	24
DATE	NOV 22	NOV 23	NOV 23	NOV 23
AREA (MAJOR, MINOR)	5E,31	5E,31	5E,31	5E,31
ARROWTOOTH FLOUNDER	5	3	7	..
DOVER SOLE	27	6	7	9
FLATHEAD SOLE	..	..	..	..
PACIFIC HALIBUT	..	..	..	..
PETRALE SOLE	..	..	..	..
OTHER FLATFISH	..	..	..	..
S. ALEUTIANUS	..	..	..	..
S. ALUTUS	159	5	14	907
S. BABCOCKI	..	..	..	..
S. BOREALIS	23	..	..	..
S. BREVISPINIS	..	2	11	..
S. CRAMERI	..	..	..	..
S. DIPLOPROA	..	..	..	..
S. ENTOMELAS	..	..	3	..
S. PRORIGER	..	..	34	14
S. REEDI	..	..	2041	45
S. ZACENTRUS	..	..	..	..
SEB. ALASCANUS	..	45	..	9
OTHER ROCKFISH	..	..	5	..
LINGCOD	..	..	..	..
PACIFIC COD	..	..	..	..
PACIFIC HAKE	..	..	..	..
SABLEFISH	..	..	..	11
WALLEYE POLLOCK	..	..	..	..
WOLF EEL	..	..	..	..
OTHER ROUNDFISH	..	..	1	..
RATFISH	..	..	..	..
SKATES	..	..	9	..
SPINY DOGFISH	..	..	..	..
OTHER SELACHII	..	..	..	..
PINK SHRIMP	..	..	..	..
SIDESTRIPE SHRIMP	..	..	..	..
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	214	61	2132	995

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	25	26	27	28
DATE	NOV 24	NOV 24	NOV 24	NOV 26
AREA (MAJOR, MINOR)	5E,35	5E,35	5E,35	5C,07
START TIME (PST)	9:12	10:42	12:46	8:31
DURATION (MIN)	15	5	14	31
START N. LAT. (DEG)	54	54	54	52
(MIN)	10.0	10.4	10.2	32.5
W. LONG (DEG)	133	133	133	128
(MIN)	45.0	45.8	45.6	54.2
START LORAN-C X	11386.0	11383.1	11384.4	13032.1
Y	30474.9	30475.3	30475.0	30415.7
FINISH N. LAT. (DEG)	54	54	54	52
(MIN)	10.3	10.3	10.9	33.5
W. LONG (DEG)	133	133	133	128
(MIN)	45.2	46.4	46.1	54.5
FINISH LORAN-C X	11384.2	11383.2	11380.1	13024.3
Y	30475.4	30474.8	30476.1	30418.8
HAUL DISTANCE (KM)	0.6	0.6	1.3	2.4
(N MI)	0.3	0.3	0.7	1.3
DIRECTION (DEG.TRUE)	335	310	320	3
BOTTOM DEPTH (M)	291- 274	300- 296	302- 262	219- 227
(FM)	159- 150	164- 162	165- 143	120- 124
MODAL DEPTH (M)	..	..	..	..
WATER TEMP. (DEG C)	5.6	5.6	5.6	0.0
GEAR TYPE	21	21	21	5
TIDE	EBB	EBB	SLACK	FLOOD
TOTAL CATCH (KG)	1012	218	714	20
REMARKS	USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	25	26	27	28
DATE	NOV 24	NOV 24	NOV 24	NOV 26
AREA (MAJOR, MINOR)	5E,35	5E,35	5E,35	5C,07
ARROWTOOTH FLOUNDER	23	9	11	2
DOVER SOLE	9	..	..	..
FLATHEAD SOLE	..	..	..	..
PACIFIC HALIBUT	32	..	..	..
PETRALE SOLE	..	..	..	..
OTHER FLATFISH	..	..	..	1
S. ALEUTIANUS	..	..	..	1
S. ALUTUS	907	181	680	1
S. BABCOCKI	..	..	..	..
S. BOREALIS	..	..	..	..
S. BREVISPINIS	..	23	23	..
S. CRAMERI	9	..	..	..
S. DIPLOPROA	..	..	..	..
S. ENTOMELAS	..	..	..	..
S. PRORIGER	..	..	..	..
S. REEDI	..	..	..	..
S. ZACENTRUS	23	..	..	..
SEB. ALASCANUS	..	5	..	..
OTHER ROCKFISH	..	..	..	..
LINGCOD	..	..	..	..
PACIFIC COD	..	..	..	..
PACIFIC HAKE	..	..	..	..
SABLEFISH	..	..	..	2
WALLEYE POLLOCK	..	..	..	..
WOLF EEL	..	..	..	..
OTHER ROUNDFISH	..	..	..	..
RATFISH	..	..	..	2
SKATES	..	..	..	..
SPINY DOGFISH	9	..	..	9
OTHER SELACHII	..	..	..	..
PINK SHRIMP	..	..	..	1
SIDESTRIPE SHRIMP	..	..	..	1
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	1012	218	714	20

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER		29	30	31	32
DATE		NOV 26	NOV 27	NOV 27	NOV 27
AREA (MAJOR, MINOR)		5C,07	5A,09	5A,09	5A,09
START TIME	(PST)	10:28	9:35	10:20	12:16
DURATION	(MIN)	30	9	18	18
START N. LAT.	(DEG)	52	51	51	51
	(MIN)	29.7	17.6	17.3	17.1
W. LONG	(DEG)	128	127	127	127
	(MIN)	55.3	39.5	40.3	40.2
START LORAN-C	X	13043.6	13830.4	13827.3	13828.6
	Y	30405.5	30162.4	30160.4	30159.4
FINISH N. LAT.	(DEG)	52	51	51	51
	(MIN)	31.4	17.7	17.6	17.7
W. LONG	(DEG)	128	127	127	127
	(MIN)	55.2	39.2	39.5	39.3
FINISH LORAN-C	X	13033.6	13831.7	13830.4	13831.1
	Y	30411.2	30163.1	30162.4	30163.0
HAUL DISTANCE	(KM)	3.1	0.4	1.1	1.5
	(N MI)	1.7	0.2	0.6	0.8
DIRECTION (DEG.TRUE)		8	47	52	34
BOTTOM DEPTH	(M)	203- 208	137- 157	164- 144	146- 137
	(FM)	111- 114	75- 86	90- 79	80- 75
MODAL DEPTH	(M)	..	..	..	..
WATER TEMP.	(DEG C)	0.0	0.0	0.0	0.0
GEAR TYPE		5	5	5	5
TIDE		SLACK	EBB	EBB	SLACK
TOTAL CATCH	(KG)	72	50	75	91
REMARKS		USABLE	USABLE	USABLE	USABLE

APPENDIX TABLE 1 (CONTINUED)

HAUL NUMBER	29	30	31	32
DATE	NOV 26	NOV 27	NOV 27	NOV 27
AREA (MAJOR, MINOR)	5C,07	5A,09	5A,09	5A,09
ARROWTOOTH FLOUNDER	..	..	5	..
DOVER SOLE	..	..	..	..
FLATHEAD SOLE	..	5	5	..
PACIFIC HALIBUT	..	..	..	..
PETRALE SOLE	..	..	..	..
OTHER FLATFISH	..	..	2	..
S. ALEUTIANUS	..	..	..	..
S. ALUTUS	..	..	..	..
S. BABCOCKI	..	..	..	..
S. BOREALIS	..	..	..	..
S. BREVISPINIS	..	..	..	..
S. CRAMERI	..	..	..	..
S. DIPLOPROA	..	..	..	..
S. ENTOMELAS	..	..	..	..
S. PRORIGER	..	..	..	..
S. REEDI	..	..	..	..
S. ZACENTRUS	..	..	..	..
SEB. ALASCANUS	..	..	..	..
OTHER ROCKFISH	..	..	..	..
LINGCOD	..	..	..	..
PACIFIC COD	..	..	..	..
PACIFIC HAKE	..	23	27	68
SABLEFISH	9	9	..	14
WALLEYE POLLOCK	5	..	..	..
WOLF EEL	..	..	..	..
OTHER ROUNDFISH	..	..	..	..
RATFISH	..	..	9	9
SKATES	..	..	..	..
SPINY DOGFISH	36	10	23	..
OTHER SELACHII	..	..	..	..
PINK SHRIMP	11	1	1	..
SIDESTRIPE SHRIMP	11	2	3	..
OTHER INVERTEBRATES	..	..	..	..
TOTAL CATCH (KG)	72	50	75	91

FOOTNOTES TO APPENDIX TABLE 1

Area: General locations of hauls are identified by major and minor areas.

MAJOR AREA	MINOR AREAS	
3C	23, 24	- southwest Vancouver Is.
3D	25	- northwest Vancouver Is.
5A	09	- south Queen Charlotte Sd.
5B	08	- north Queen Charlotte Sd.
5C	02, 07	- south Hecate Strait
5E	31, 35	- west coast of Queen Charlotte Islands

Catch: other flatfish includes: English sole (*Parophrys vetulus*);
rex sole (*Glyptocephalus zachirus*)

other rockfish includes: green striped rockfish (*Sebastes elongatus*);
yellowtail rockfish (*S. flavidus*);
rosethorn rockfish (*S. helvomaculatus*);
bocaccio rockfish (*S. paucispinis*);
canary rockfish (*S. pinniger*);

other roundfish includes: Pacific tomcod (*Microgadus proximus*)

Appendix Table 2. Common and scientific names of species encountered.

Common name	Scientific name
FLATFISH	
Arrowtooth flounder	*Atheresthes stomias*
Dover sole	*Microstomus pacificus*
Lemon sole	*Parophrys vetulus*
Pacific halibut	*Hippoglossus stenolepis*
Petrale sole	*Eopsetta jordani*
Rex sole	*Glyptocephalus zachirus*
Flathead sole	*Hippoglossoides elassodon*
ROUNDFISH	
Rougheye rockfish	*Sebastes aleutianus*
Pacific ocean perch	*S. alutus*
Redbanded rockfish	*S. babcocki*
Shortraker rockfish	*S. borealis*
Silvergray rockfish	*S. brevispinis*
Darkblotched rockfish	*S. crameri*
Splitnose rockfish	*S. diploproa*
Widow rockfish	*S. entomelas*
Yellowtail rockfish	*S. flavidus*
Rosethorn rockfish	*S. helvomaculatus*
Bocaccio	*S. paucispinis*
Canary rockfish	*S. pinniger*
Redstripe rockfish	*S. proriger*
Yellowmouth rockfish	*S. reedi*
Sharpchin rockfish	*S. zacentrus*
Shortspine thornyhead	*Sebastolobus alascanus*
Pacific cod	*Gadus macrocephalus*
Sablefish	*Anoplopoma fimbria*
Walleye pollock	*Theragra chalcogramma*
Lingcod	*Ophiodon elongatus*
Hake	*Merluccius productus*
SELACHII	
Ratfish	*Hydrolagus colliei*
Dogfish	*Squalus acanthias*
Skate	*Raja* spp.